THE
ELECTRICAL REVIEW.

VOL. LXXXIII. AUGUST 30, 1918. No. 2,127.

ELECTRICAL REVIEW.

Vol. LXXXIII.] CONTENTS: August 30, 1918. [No. 2,127.

	Page
A German Reduction and a British Moral	193
The A.E.G. and Manufacturing in Sweden	194
Hydro-electric Power	194
Hydro-electric Power in Canterbury, New Zealand (*illus.*) ...	195
Water-power, by T. Smith (*illus.*)	197
The Faraday Society	198
New Electrical Devices, Fittings and Plant (*illus.*)	198
Fuel Economy in Electric Power Stations	199
Correspondence—	
Telephone Maintenance	200
Trade Unions: Past, Present and Future	200
Motor Problems	200
Our Friends at Ruhleben	201
Technical Instruction for British Interned in Switzerland (*illus.*)	201
Coal Conservation	201
War Items	202
Business Notes	202
Notes	206
Trade Statistics of New Zealand	209
City Notes	210
Stocks and Shares	211
Market Quotations	212
Turbine House Plant Operation, by T. G. Otley and V. Pickles	213
The British Scientific Products Exhibition (*continued*) (*illus.*)	214
The Aylesbury Electricity Undertaking, by W. A. Turnbull...	216
New Patents Applied for, 1918	216
Abstracts of Published Specifications	216
Contractors' Column ... ... Advertisement page xxii	

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY

OFFICE: 4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: "AGKERAY, CENT., LONDON." Code, A B C
Telephone Nos.: City 977; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 8d.; Canada, £1 3s. 10d. ($5.80). To all other countries, £1 10s.

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A GERMAN REDUCTION AND A BRITISH MORAL.

WE have not hesitated to give our support to reasonable demands for increased wages and salaries required to enable the production of war munitions to be satisfactorily maintained. It is deplorable, however, when demands are made which are not due to the altered cost of living, but are the outcome of differences of opinion among the workers as to the rights or merits of competing classes. Not less deplorable is it when organs of great influence foster the belief that all the workers have to do is to ask and they will receive. While we favour better pay up to a certain point, we believe that the utter prodigality which is present in the payment of wages and bonuses in many parts of the country just now is adding immensely to the industrial difficulties of the post-war period. We have no means to suggest whereby any alteration can be introduced at the present juncture; indeed, while the cost of certain articles of food continues to soar there will also continue a pretext for new demands. But there must come an end to these high wages sooner or later when the volume of war work falls away. They will not, in industries that we represent, fall to pre-war figures, nor does anybody wish them to do so, but the present high rates of pay are practically certain to leave a shadow over industrial conditions when we return to competitive and commercial days. The sooner the brake can be applied without too great friction, the better it will be for all in the future. Many will be the factors contributing to ultimate decrease—whether it come gradually or suddenly—and the process of readjustment will bring a multitude of problems in but this single connection.

Although wages are still rising in this country owing to the continuation of high-speed production of war requirements for our Allies and for ourselves, it will be well if those who are responsible for Labour movements acquaint themselves with what is happening in some parts of Germany even now.

It may be that reduction of wages of people already overburdened with the high cost of living and short of many of the necessaries of life will be one of the last straws which will bring about the end of the war, but the German people is still living under the accumulated influence of long years of State discipline. Be these things as they may, it is a fact, if we are to believe the *Vorwärts* of July 2nd, that various munition works in Germany report reductions in wages.

It is stated that the managers of the Gartenfelde Powder Mills, a branch of the Siemens-Schuckert Works, "have struck a violent blow at the existing wage rates." For some reason or other, there are "fewer orders and lower prices," and in consequence notice was issued on June 27th announcing that the said managers were "reluctantly compelled" to restrict their output and to introduce a "slight reduction" in wages as from July 1st, when the rate, compared with the old scale, would be as 5 to 7. A similar reduction here would mean that a wage would fall from 70s. to 50s. per week. We should like to think that such a drop would be accepted with a good grace when, if ever, it became necessary here. This rate of reduction is, of course, considerably less than the war-time increase; but its introduction while prices remained high would be sure to raise a pretty considerable storm. We have had a small experience of labour demobilisation already, when some thousands of women who were no longer required to work upon a particular class of munitions could not be found other occupation without a period of waiting. When the war is near its end the Ministry of Munitions will not find it so easy to negotiate such positions, for there will be no other branch of war requirements to which to transfer employés.

The peculiarity about the Gartenfelde development

is that it is attributed to the lowering of contract prices. The *Vorwärts* calls this an "excuse," and in absence of the full particulars, a wage reduction of the proportion mentioned would seem to indicate a very considerable drop in contract prices, unless the volume reduction is large. In view of the big profits that have been made in Germany, where the manufacturers have been highly favoured with freedom from special taxation, the event has a slight trade significance. They have been able to build up huge reserves, which are labelled for "After-War-Trade" purposes, and many millions of marks have been invested in German War Loan. Now the *Vorwärts* suggests that the said manufacturers, "after the enormous profits that they have made," could "accept lower prices without feeling it"! Does that mean executing future war and other contracts at a loss in order to remunerate Labour, or does it mean drawing upon those reserves? Labour could hardly advance such a suggestion here after all the Excess Profits taxation that British works have had to carry; but we do well to note the German circumstance. It may be that German manufacturers will not find those immense reserves of very great value when they want to realise them for After-War-Trade schemes. Perhaps they will be not more than much depreciated little "Scraps of Paper," for Nemesis is relentlessly on the track of the Wrong-doer. If the German workers' claim for war profits to be disgorged were to become general, there would not be even those depreciated "scraps" left. Germany has to pass through more serious economic crises than have yet arisen; the whole future in that respect is very uncertain. The complaint of the *Vorwärts* is that "it is not fair on the workers" to suppose that "at a time when every commodity is becoming dearer, they should put up with a 30 per cent. reduction of wages." We rather fancy that such language is mild compared with what will one day be heard from the hungry workless multitudes of Germany. The shining sword of the War Lord is already failing to maintain the spirits of the industrial and trading classes, who contemplate the closing of thousands of factories and the emigration of the people, because the Civilised World is economically, as well as militarily, against Prussian Militarism and all its works. What will follow? Low wages with which the people will struggle to compete with the workers of such industrial nations as our own, whose wages even now continue to rise? The Allies must have their safeguards. This is no time to talk of the compassion of the Victor—we have to win the war.

Does not the foregoing episode of what is happening in Germany suggest the crying need for cautioning the industrial workers of England to be prepared for the less prosperous conditions that are developing in the womb of time? The profiteer in every department of activity will yet reap his reward, be he munition worker, adventurer, or capitalist. By whatever process that may happen in the case of the others, it will come as a self-imposed burden on the big wage-earner who spends excessive earnings with extravagant freedom, forming habits which the future will not be able to maintain. When the *Times* urges that Labour be given anything it pleases to ask for, does it not recognise that it is putting an axe at the very root of the industrial tree?

The A.E.G. and Manufacturing in Sweden.

The manufacture of electrical machinery and accessories in Sweden has undergone considerable development in recent years, the object being not only fully to satisfy the demand in the home market, but also to stimulate the export trade. According to the report for 1917 of the Allmänna Svenska Elektriska A.B., the company had on hand orders representing a value of £1,648,000 at the end of last year, and at the recent general meeting Mr. J. S. Edström, managing director, explained that the stock of orders had increased, notwithstanding the reduction in the value of the exports. The reason was to be found in the fact that the country's own requirements in electrical machinery and plant were now greater than at any previous period, as the use of electricity was extending in a measure which no one could have foreseen. It was, therefore, necessary for the company to exercise its forces as far as possible, in order to meet the demands made upon it. The question of raw materials represented a difficulty, but for a time the company had been fortunate in covering its needs by means of purchases from America and Russia, and at the same time great efforts had been made to render the undertaking independent of imported raw materials. It would, however, the directors stated, no longer be possible for the company to manufacture exclusively with the use of Swedish raw materials.

Another side of the question is represented by the announcement that the Elektriska Aktiebolag A.E.G., of Malmo, which is a subsidiary of the Berlin A.E.G., proposes to erect large works at Malmo harbour for the production of machines and transformers, at an estimated expenditure of £439,000. The Conservative newspaper *Allahanda*, which characterises this scheme as a menace to the position of the Swedish industry, states that the reason for the project lies in the import duties on machinery. Yet the promoters, it is said, can obtain from the Berlin company cheap machine parts upon which the duties are low, and also procure Swedish raw materials, which are superior. But the principal object of the proposed new undertaking is declared to be the production of machinery for export to Russia and South America, where the Swedes already have found a market, and where further competition would be encountered from this source in addition to that directly undertaken by German firms in the past. Despite declarations to the contrary, the newspaper submits that it is not certain that the company will not seek to conquer the Swedish market, and notwithstanding the increased strength gained in Sweden through the amalgamation of firms, it is suggested that both the electrical industry and the Government have every reason to devote the greatest attention to the plans of the A.E.G.

Hydro-electric Power.

In our last issue we concluded an abstract of the Report of the Water-Power Committee of the Conjoint Board of Scientific Societies on the water-power resources of the British Empire, which are shown to be of immense potential value; to-day we give an account of the development of the undertaking carried out by the Government of New Zealand at Lake Coleridge, showing how quickly a cheap supply of electrical energy is snapped up by an enlightened population, and how diversified are the innumerable applications to which it is put. These articles relate to the major water-powers; but the minor waterfalls are not to be ignored, for they also have useful functions to fill, and within their natural limitations they are just as effective in economising fuel and labour as the larger ones. What can be effected in this direction is admirably exemplified in our columns to-day by Mr. Thos. Smith's account of the work accomplished in Wales, where a single firm has covered the map with small installations, mainly on farms. No doubt there are very many more of the same kind—if not, there ought to be.

We have on previous occasions pointed out that, while this country is not blessed by Nature with many large water-powers, there are numerous opportunities for harnessing waterfalls of small capacity, the energy derived from which can be advantageously employed in the vicinity. The urgent necessity of employing mechanical power on farms needs no demonstration; the alternative to using water power is the consumption of fuel in some form, usually oil or petrol, both of which occupy cargo space which is so precious now. Hence, as Mr. Birks remarks in connection with the Canterbury scheme, the use of water-power to replace these fuels has an increased importance from the national point of view, while the fact that electricity is the only medium by which this can be done renders the subject of immediate interest to the electrical industry. Moreover, there is no source of power which is so easily controlled by the non-technical user. At the same time, the development of these small powers will assist our turbine makers in preparing to tackle the large ones in Greater Britain. We trust that in the future, with more intelligent co-operation between the Government, the financial world, and the *British* manufacturer, the harnessing of Imperial water-powers will be secured to this country—too often in the past such work has been thrown into the hands of foreigners by the short-sighted policy of our financiers and the contempt of Government Departments for British industry.

HYDRO-ELECTRIC POWER IN CANTERBURY, NEW ZEALAND.

We are indebted to Mr. Lawrence Birks, B.Sc., M.Inst.C.E., M.I.E.E., electrical engineer to the Public Works Department, Christchurch, New Zealand, for the following particulars regarding the development of hydro-electric power in Canterbury, using the waters of Lake Coleridge.

The first proposal of this nature was put forward by Mr. A. D. Dobson in 1899, and contemplated the derivation of 5,000 KW. from the Waimakariri River, for the supply of Christchurch 30 miles away, at 30,000 volts; but the

Fig. 1.—View of Lake Coleridge, showing the Intake.

Government took up the matter, and the scheme assumed more imposing dimensions, becoming of provincial importance. Consequently, a much larger source of power had to be sought, and this led to the investigation of the capabilities of Lake Coleridge by Mr. P. S. Hay, then Engineer-in-Chief, in 1904. A partial supply of electricity had been provided by the Christchurch City Council from a refuse destructor in 1903, in which year Mr. Birks was appointed City Electrical Engineer, and the demand rapidly developed, necessitating extensions within the second year. The outlay on the City plant grew from £12,360 in 1904 to £88,691 in 1913, when the output had reached the value of 1¼ million units per annum, and the plant capacity was 950 KW.

The Tramway Board in 1905 started its own power station, which was equipped with three Curtis vertical 500-KW. turbo-dynamos; these machines are remarkable in that they are said to be the only D.C. sets of this type which have run for years, fully loaded, without the slightest hitch. In 1910 a horizontal 1,000-KW. set was added.

In that year it was decided that the City Corporation should retain the distribution of electricity within its area, and that the Government should develop the water-power scheme, supplying local authorities, &c., in bulk. By an Act passed in August, 1910, the Government was authorised to borrow £500,000 for the development of water-power throughout the Dominion, and in the following year Mr. Evan Parry, B.Sc., A.M.Inst.C.E., M.I.E.E., was appointed chief electrical engineer to design and carry out the works. In 1914 the Lake Coleridge installation was completed and put in operation.

The city system was supplied by means of two rotary converters, providing a load of 1,000 KW. for the water-power plant from the first day of operation. The output or 1916 was nearly five million units, but the large power users cautiously waited to see whether the system would prove satisfactory, so that about a year elapsed before the load began to go up rapidly. The output for the second year of operation was over 14 million units.

The Lake Coleridge power plant was designed for an ultimate capacity of four generators of 1,500 KW. capacity each and two of 3,000 KW. capacity each. Of these, three sets were erected and put into commission at the opening. The growth of the demand for power led to the installation of the fourth set, which was put into service in March, 1917, making a total installed capacity of 6,000 KW. A fifth set, of 3,000-KW. capacity, is now on order, but owing to war conditions it has been found impossible to get delivery of the steel for building the necessary pipe line. The rising prices of coal and gas have stimulated the demand, and in the meantime a definite restriction has had to be imposed so far as the consumers of day power are concerned.

Lake Coleridge has an area of about 13 sq. miles, lying at an elevation of 1,667 ft. above the sea, and at a distance of 65 miles almost due west of Christchurch. At the eastern end the Rakaia River bed is 500 ft. below the lake level, and less than 2 miles distant from the lake shore, giving an ideal opportunity for the development of hydro-electric power. The available power for future development is very high, running up to 20,000 KW. of continuous load, or 40,000 KW. on a 50 per cent. load factor.

From the lake the water is taken through the ridge separating it from the Rakaia River by a submerged tunnel, 7,000 ft. long, 8 ft. high and 8 ft. wide. The water is delivered into a surge-chamber, 35 ft. in diameter and 33 ft. deep. This is provided with four outlets, each with substantial cast-iron gates. Two pipe-lines are now in service, each 52 in. in diameter and 2,480 ft. long, and each capable of supplying 3,000 KW. at a working head of 480 ft. Provision is made for two similar pipe-lines, thus developing the tunnel to its full capacity, and involving the installation of 12,000 KW. of plant.

The power house is a substantial ferro-concrete structure, 180 ft. long, 70 ft. wide, and 40 ft. high, and is built complete to house the whole 12,000 KW. of plant. The

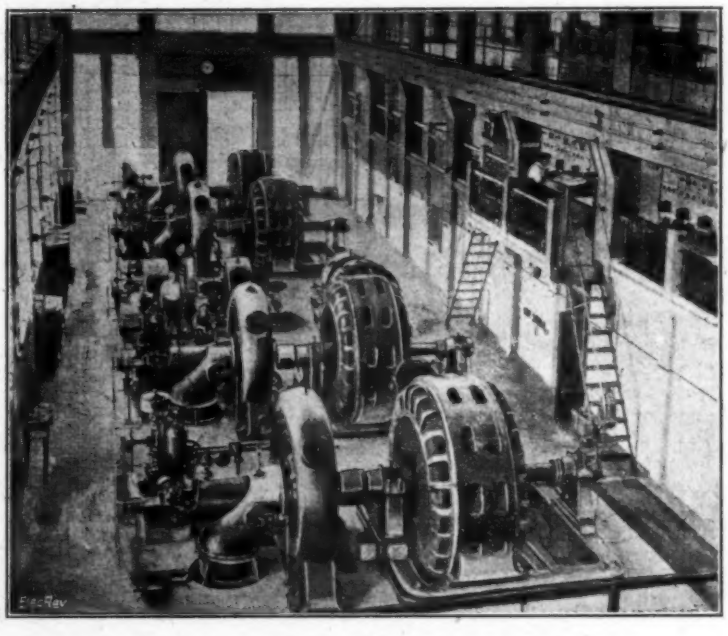


Fig. 2.—Interior of Power House.

two existing pipes supply four Francis turbines, coupled to 1,500-KW. alternators. Complete switchgear is provided, with remote-control oil switches for each circuit. The pressure is raised for transmission to Christchurch by means of two banks of step-up transformers, each bank consisting of three 1,500-KW. units, raising the pressure from 6,600 to 66,000 volts, at 50 cycles per second.

The power house is also provided with complete lightning-

arresters, travelling-crane, compressed-air system, transformer-oil drying and filtering systems, machine shop, fitters' shop, blacksmiths' shop, stores, and garage.

The staff is provided for with 16 cottages, all equipped with complete electric lighting, heating, and cooking systems. A suitable school, a small farm, and an extensive plantation have been provided.

From the power house the energy is conveyed to Christchurch over two independent transmission lines, each 62 miles long, and terminating at the main distributing station at Addington. The poles are 42 ft. long, standing

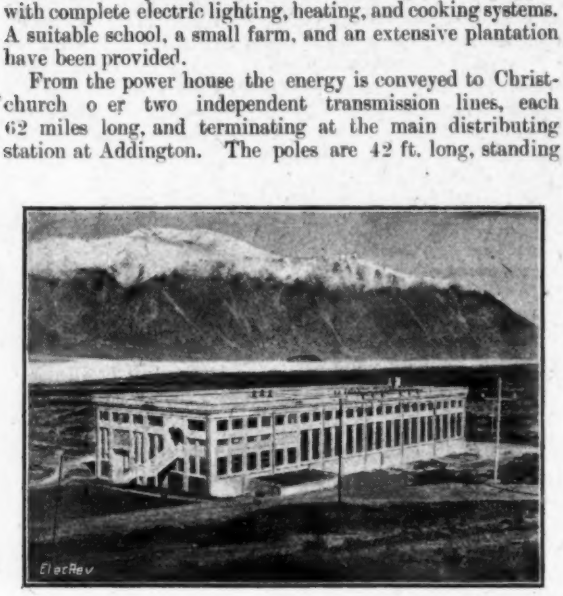


Fig. 3.—Power-house Building and Rakaia River.

36 ft. out of the ground, and spaced on level ground about 400 ft. apart. One span is as long as ½ mile, and has given no trouble.

The lines consist of three cables per circuit, each cable being 7/·135, or one-tenth of a square inch of aluminium. A metallic telephone circuit is carried on each line, with telephone huts every 5 miles; each hut is equipped with line material and tools, thus serving as an emergency depôt, in which capacity they have proved invaluable.

The transmission lines are not yet tapped at any point *en route*, supply only being available hitherto on the primary feeders going out from the Addington distribution station.

For the first few months the lighting load exceeded the power load, but now that the larger factories have been converted to electric driving, the day load—8 am. to 5 p.m.—considerably exceeds the evening lighting load. The peak is usually between 8 and 9 a.m., being determined by the tramway load. There is a drop of about 1,000 kw. at mid-day for the lunch hour. The most striking feature of the load-curve is the high load-factor, which ranges on the weekly output up to 61 per cent.

At the main distributing station the pressure is transformed down to 10,500 volts, at which it is distributed over six primary distributors, each in duplicate and of 1,000-kw. capacity. Underground cables are employed in the city area, and overhead lines to outlying sub-stations, two of which are respectively 19 and 23 miles distant.

The Christchurch City Council purchases energy in bulk from the Department at 10,500 volts pressure, providing its own transforming and distributing stations, at which the pressure is reduced to 400/230 volts, three-phase, for retail supply. The peak load on the city mains in June, 1917, was 2,200 kw., of which 2,000 was supplied from Lake Coleridge, and the balance was taken by the city's own generating plant.

On the introduction of hydro-electric power in the city the Council's average charge for light was reduced from 5d. to 3d., and for power from 2½d. to 1d., with wholesale power rates down to ½d. for ordinary day work and to ¼d. for night work.

In two years after a regular supply was obtained from Lake Coleridge the demand within the city had gone up from about 700 kw. to 2,200 kw., and was still increasing rapidly. During the same period the number of consumers within the city had gone up from 1,625 to 3,877, of whom 22 per cent. paid less than 3s. per month and 33 per cent. less than 4s. per month on the average. Electricity in Christchurch is thus distinctly the "poor man's light."

The next largest consumer is the Christchurch Tramway Board, with a normal day load of 1,400 kw. The effect of the introduction of Lake Coleridge power has been to reduce the cost of power for operating the tramways by over £2,000 a year, although the steam plant previously used was of a highly efficient type.

The next largest consumers consist of three large freezing works; their load consists mainly of large freezing motors of 100 to 500 h.p., running on a seasonal load from December to about July in each year, but running 24 hours per day during most of the killing season. They also have a general day motor load of 100 to 200 kw. during the killing season, falling off very much during the slack season.

The freezing industry thus leaves a slack period of four or five months from July to November, in which about 600 kw. will be available for the development of suitable industries, the operations of which can be adjusted to suit the slack season at the freezing works, and should consist in the working-up of their by-products by electrochemical methods, or of other electrochemical processes. Owing to the fact that the industries are already paying for the power they use in the killing season, it will be possible to continue this supply throughout the year for such purposes at a very small increased charge.

All the flour mills within reach of the present mains are taking a supply. The price at which energy is available from Lake Coleridge has enabled the cost of milling power to be reduced from about 4s. 6d. to about 2s. per ton. Moreover, the absolute uniformity of speed and rotating effort of the electric motor as compared with the steam or gas engine has made a great improvement in the operation of the milling machines, and there is a strong demand for extension of the mains to other milling centres.

Five out of eight tanneries and fellmongeries in the district, apart from the freezing works, are now supplied, and the other three will be connected up as soon as power is available.

All the dairies and butter factories within reach of the mains are now supplied, in spite of the necessity of raising steam for pasteurising, scalding, and washing. For separating

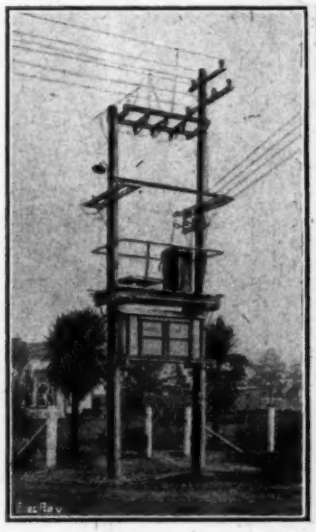


Fig. 4.—Sockburn Pole Sub-station—a typical cheap out-of-door Sub-station on 10,500-volt Line.

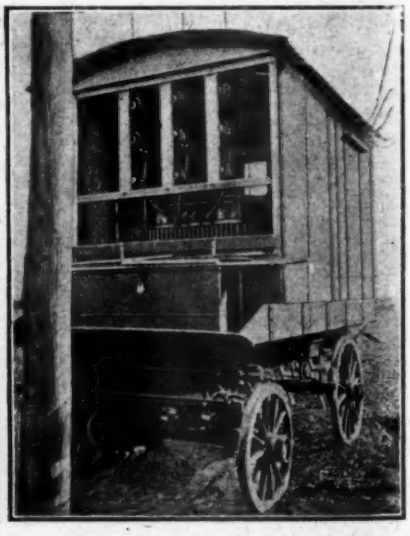


Fig. 5.—Portable Sub-station (50 kw.) for Builders, Farmers, and others requiring a Temporary Supply.

and churning, the steadiness and uniformity of speed are of great advantage as compared with the steam engine. For milking machines the ease of starting and stopping, and the unattended operation of the motors, as well as the cheapness of the power as compared with petrol and kerosene fuel, determine the matter without question, and are making quite a revolution in dairying matters wherever the mains are accessible. A most striking development has been the success of the Tai Tapu Dairy Co. This company buys power in bulk for operating its butter factory in Tai Tapu, and also reticulates the district for retail distribution to its suppliers and consumers within its district. There are now 11 miles of 3,000-volt and 6 miles of low-tension line, supplying 76 consumers, including 25 milking machines. The financial results have been very satisfactory to all parties—the farmer, the dairy company, and the Department; production has been stimulated, and one of the comforts of the city has been carried out to the hard-working dairy farmer.

Two large quarries, three large brickyards, and one pottery are now driven by Lake Coleridge power, and others are waiting for a supply. In these cases the large instantaneous overload capacity of the electric motor is of the utmost value. It is found in nearly every case that the former engines were very much overpowered for their average work, owing to the necessity of their carrying an occasional overload without stopping, which the electric motor does without difficulty.

Six hospitals and similar institutions are supplied from the mains, in most cases on the maximum demand system, at £1 per month per kilowatt of maximum demand. This enables them to utilise the energy for a wide range of purposes with the highest economy. If used for lighting only, for an average of, say, 1,000 hours per year, it works out at under 3d. per unit. But up to the lighting capacity the energy can be used on this scale at other hours of the day at no additional cost. It is thus available for heating, cooking, refrigerating, pumping, milking, shearing, chaff-cutting, sawing, sewing, and ironing and other laundry work. Between 10 p.m. and 9 a.m. it is used for hot-water heating, at no additional cost. At Sunnyside Hospital, by combining all these operations and keeping a graphical record of the demand by means of a curve-drawing watt-meter, the energy is obtained for all purposes at a rate below two-thirds of a penny, which still yields to the Department a satisfactory return of £1 per month per kilowatt of maximum demand.

The retail supply in the suburban and country areas is, as far as possible, handed over, as in the city, to the local authorities. Three of them purchase their energy in bulk through the City Council. The others are supplied from the Department's mains, with an arrangement under which the Department and the local authority share the gross revenue, the local authority undertaking the complete installation, control, maintenance, and management of the reticulation in return for its share of the revenue, and the Department simply supplying the necessary power in bulk. In these cases the Department installs and maintains the necessary sub-stations to reduce the pressure from 10,500 volts to 230 volts for retail distribution. These are usually small—10 KW. to 50 KW. capacity—and for this purpose a cheap type of outdoor-pole sub-station has been developed. For temporary service or for emergency supply pending the installation of a permanent sub-station, a portable van has been equipped with a 50-KW. transformer and high and low-tension switchgear, and has proved of the utmost value.

There are in all 13 local reticulations, having a total connected load of 17,083 KW.; the diversity factor is 4·38, and the load factor 54 per cent.

Marked economy in the use of coal in Canterbury has resulted from the operation of the Lake Coleridge plant. The coal consumption in the most efficient and well-designed steam plant in Canterbury—the tramway power station—was over 5 tons per horse-power year, working on about a 50 per cent. load factor. The ordinary small commercial steam plant consumes from three to five times as much coal as this, though, as its low factor is low—usually 10 per cent. to 20 per cent.—the owner does not, as a rule, realise how much coal per actual horse-power-hour it is using. It is found in practice that the average power actually used in small factories is usually from one-half to one-quarter of what the owner estimates. The average small steam plant on a 15 to 20 per cent. load factor actually uses 6 to 8 tons of coal per horse-power per annum; and thus the Lake Coleridge plant, replacing such plants and working up to a 50 or 60 per cent. load factor, saves 15 to 25 tons of coal per annum per horse-power of its useful output. The aggregate saving is estimated at 50,000 tons, worth £75,000 delivered into the coal bins, or £100,000 delivered into the boiler fires, and represents the labour of nearly four hundred men, who are replaced by 60 to 80 men engaged on operating and maintaining the Lake Coleridge power plant, distribution, sub-stations, and reticulation.

To some considerable extent the electric power has replaced kerosene and petrol instead of coal; but to this extent the saving is of even greater national importance, in that it has substantially reduced ocean and railway transport, and has reduced the national liability to foreign creditors by probably £10,000 per year.

There are about a dozen electric vehicles in use in Christchurch for various purposes, and provision is being made in anticipation of this number increasing to 500 or 600 in the near future.

Lake Coleridge power has already enabled sulphate of iron, formerly imported by the gasworks for purifying the gas, to be replaced by hydrate of iron produced from the old tins from the destructor. A further development of the same industry will yield an iron-oxide paint that was previously imported. Arrangements are being completed for the local manufacture of caustic soda and hydrochloric acid by the electrolysis of common salt by means of Lake Coleridge power. Another industry in which hydro-electric power will take an essential part is the manufacture of calcium carbide, and thence calcium cyanamide, ammonia, and all the important group of nitrogenous products, including explosives. Already preliminary work is being done on the direct electrolysis of water on the large scale to yield oxygen for acetylene welding and hydrogen for the hardening of fats.

In Australia it is found profitable to smelt steel by means of the electric furnace even with electricity generated from steam at a cost of ¼d. per unit. The product is of such high grade that it is used largely for purposes for which brass and gun-metal were previously required. Such furnaces can be conveniently operated at night, the moulding being done in daylight. This makes it possible to supply the power for them at a very cheap rate—less than one-third the rate at which it pays to buy energy for the same purpose in Australia. At the present prices of scrap steel and Lake Coleridge power it will be possible to smelt high-grade cast-steels at substantially less than the pre-war cost.

In these and other directions the introduction of cheap hydro-electric power is already resulting in Canterbury in a step forward in industrial and economic conditions more far-reaching in their results than the most sanguine predictions.

WATER-POWER.

By THOMAS SMITH.

THERE is a tendency on our part, when dealing with the question of the development of water-power, to take into account the comparatively large units only, and to regard small rivers and streams as not worthy of consideration. We are, to a very great extent, led to this conclusion by the reports of the magnitude of the works carried out in Canada, India, Australia, and other parts of the Empire, together with the lack of information about what is being done in our own country. While we have to admit that in this country suitable sites for units of 1,000 H.P. and above are not very numerous, we are apt to fail to realise that it is not the large units of power only that matter.

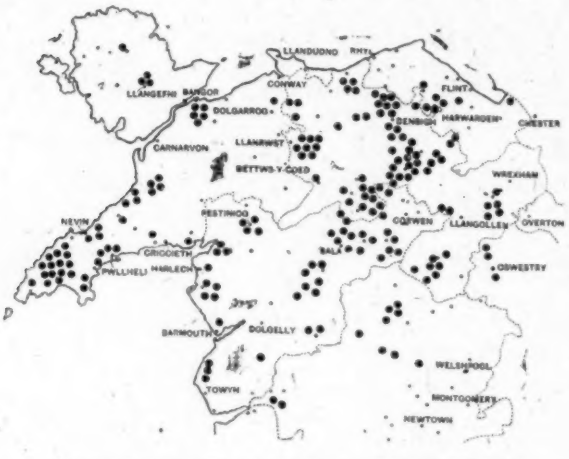
Agriculture, an industry the importance of which is more keenly appreciated in this country than ever before, demands a very considerable amount of animal and human labour. During the last few years the application of power to farming operations has been very much extended, this being not only a benefit to the industry itself, but a source of important national economy.

D

In this connection we have an opportunity of applying water-power in a direct manner, and on a very important, if small, scale. The turbines or water-wheels may be used for power purposes directly, or, what is much more profitable, for the generation of electricity for lighting, heating, power, and culture purposes.

If we omit traction and haulage work, we find that the requirements of the average farm comprising up to 100 acres are not more than 3 H.P., and that 10 H.P. will suffice for almost any farm. From available records of 234 British water-power installations used exclusively for farm purposes, it is found that the maximum horse-power of any unit is 9, and that the average is 3·6 H.P.

That North Wales is very much to the front in this particular work will be realised from the accompanying map. This shows what has been done by one engineering



Hydro-electric Installations on Welsh Farms.

firm during the past seven years. Messrs. Richards Edwards, Llanuwchllyn, with whom the writer is associated, have made a speciality of this class of work, and have carried out some very interesting installations.

The following table gives particulars of the installations put down between 1907 and 1917, and gives the sizes of the installations, together with the nature of the work for which the power is used :—

No. of installations.	Maximum horse-power.	Minimum horse-power.	Average horse-power.	Total horse-power.	Nature of work for which the power is used.
221	9	1	3·72	822	Farm power.
13	7	2	3·5	45·5	Farm lighting.
10	14	6	10	100	Corn mills.
8	9	1	3·75	30	Pumping.
6	16	7	11·2	67	Saw mills.
4	27	5	14	56	Public supply.
4	18	11	14	56	Quarries.
2	2	2	2	4	Pri. house lighting.
1	13	—	—	13	Bakery.
1	12	—	—	12	Clover mill.
1	8	—	—	8	Tannery.
1	5	—	—	5	Woollen factory.
1	2	—	—	2	Laundry.

The possibilities of this class of work are most extensive ; but under present conditions it is impossible to cope with even a very small fraction of the work in hand. It is to be hoped, however, that under the influence of the Water Power Committee, facilities will be granted to enable the work to be proceeded with, particularly in view of the necessity of increasing the output of our farms.

Engineman Fined.—For being under the influence of liquor while at his work, John Boyle, engineman, Irvine, was fined £5 at Ayr Sheriff Court. It was stated that he had ten pumps driven by electricity under his control, and was so much under the influence of liquor that he had to be taken away from his work.—*Scotsman.*

THE FARADAY SOCIETY.

The Society held its final meeting of the session on July 23rd, when a group of papers, mainly of metallurgical interest, was presented. Sir Robert Hadfield, the President, was in the chair.

The Chemistry of Aluminium—A New Aluminium Oxide.

Mr. John Rhodin, F.I.C., read a "Note on the Chemistry of Aluminium and Aluminium Alloys," which dealt with the sorting of various kinds of scrap, according to their aluminium content. The difficulty encountered was that there existed no direct analytical method of determining aluminium, and Mr. Rhodin has therefore evolved one, full details of which are given in his paper. It is based on the separation of aluminium metal from the oxide by dissolution in 10 per cent. Na OH_3, and subsequently dissolving the oxide in nitric acid. It must be added that the method was severely criticised by Dr. Seligman and Dr. Gwyer, but supported by Mr. Geitin, who claimed that it yielded reliable results in practice.

Of more general interest is Mr. Rhodin's claim to have isolated a new oxide of aluminium, $Al_3 O_4$. It is well known how rapidly aluminium sway or powder, and more particularly that formed from the alloy duralumin, will oxidise in moist air. When the sway is melted the oxide is held in the melt, but the $Al_3 O_4$ is supposed to be soluble in the aluminium, and only to be detected by removing the excess of aluminium with an alkali. Another point of interest touched on by Mr. Rhodin is the use of specific heats as a guide to finding the composition of aluminium alloys. The method has not yet reached a practical stage, but it is promising enough to deserve further study.

A paper on the metallography of aluminium was presented at the same meeting by Mr. Robert Anderson, of Cleveland, U.S.A. The paper describes recrystallisation and grain-growth phenomena as observed to take place in rolled aluminium sheet on annealing, and it must be studied in conjunction with the photomicrographs printed with the paper. Generally speaking, aluminium is observed to behave much as other metals ; annealing restores the crystalline structure destroyed or distorted by mechanical working, but the process of recrystallisation is comparatively slow in the case of aluminium.

The Action of Sea Water on Reinforced Concrete.

The possibilities of reinforced concrete ships render the question of the action of sea water on the iron reinforcements a matter of great practical importance. Prof. H. J. M. Creighton, of Swaithem College, U.S.A., has been investigating this matter. He has embodied the results of his studies in a paper which he has communicated to the Faraday Society through the President. Of course, if the concrete is quite impermeable to water, no question of corrosion arises. As a matter of fact, in this country, as was pointed out by Dr. Desch, the quality of the concrete seemed to be such that whereas some reaction took place with sea water in the outer layers, the dense products prevented further penetration, and saved the reinforcements from corrosion. Striking examples adduced by Prof. Creighton, however, showed that this was not always the case. Once the sea water gets to the iron, electrolytic action is bound to be set up, and the large volume of the products, iron oxide and hydrated oxide, develops an enormous expansive force that causes great cracks to form in the concrete. The problem is, therefore, how to keep out the sea-water. Waterproof paints are not satisfactory, in Mr. Creighton's opinion, and he makes the striking suggestion to coat the concrete with a very thin layer of metal by means of the well-known Schoop metal-spraying process. It is to be hoped that this idea will be put into practice and tested on a practical scale. Such artificial protection, however, must not give rise to the use of inferior concrete ; and for the construction of ships it is essential to use a pure cement of fine pulverisation, low in alumina (which reacts in sea-water) and high in silica, absolutely free from lime, slow in setting and quick in hardening.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Combined Ignition, Lighting, and Engine-Governing Set.

One of the features of the automobile movement on the other side of the Atlantic which is also becoming prominent in this country is the increasing use of petrol motor tractors in hauling ploughs and other agricultural machinery. So extensive has the business in tractors become, that several of the concerns producing electrical fittings and apparatus for motor vehicles are now devoting attention to similar requirements for agricultural tractors. The Remy Electric Co., of Anderson, Ind., has lately introduced a device which not only provides for the ignition of the explosive charge in the engine combustion chambers and for the lighting of the vehicle when used at night, but also acts as an engine speed-controller or governor.

The governor acts on the following principle :—Any rotating apparatus which absorbs power must have at least two members, one rotating, the other stationary, the absorption of power being due to the reaction between the two. In order that the apparatus

may absorb power, it is necessary by some means to resist the turning action on the stationary member. An electric generator absorbs mechanical energy, and changes a large proportion of it into electrical energy, the two essential members being the rotating part—the armature, and the stationary portion—the field. At a given armature speed, the tendency to turn on the part of the stationary field depends on the amount of mechanical energy absorbed, which in turn depends upon the amount of electrical energy produced. Therefore, by varying the output of electrical energy, either the resistance to turning or the speed at which this resistance will be realised will be varied.

In the new equipment this principle is utilised by having the stationary or field-magnet member rotatably supported, and the tendency to the rotation resisted by a spring of predetermined resilience. The field-magnet remains in its normal position until the speed of rotation has become such that the reaction between the field and the armature overcomes the spring, whereupon the field magnet commences to move in the same direction as the armature, the degree of movement being through an arc of 30°. A connection is provided between the generator and the carburettor throttle, whereby an angular motion in the same direction as the armature tends to close the throttle, thereby slowing down the engine.

If a different controlled engine speed is desired, it is necessary to change the magnetic strength of the field, and this is done by inserting resistance in the field circuit or cutting it out. With increased resistance in the field circuit the reaction at a given armature speed is less, so that the spring causes a retrograde movement of the field magnet, opening the throttle, and, by admitting more fuel to the engine, allows the speed of the latter to increase. On the other hand, with reduced resistance in the field circuit the reaction will close the throttle against the action of the spring.

The range of speed control is from about 500 revolutions to 1,500 R.P.M.

The generator employed is a simple shunt-wound machine. The current output is automatically controlled at, approximately, 6 amperes at all operating speeds. It is stated that 1½ amperes are utilised for ignition while the engine is running, and that 4½ amperes are constantly going into the battery. The motor for starting the engine is a separate unit.

B.T.H. Lever Switches.

We have received from the British Thomson-Houston Co., Ltd., Rugby, the new illustrated descriptive list No. 4110 on lever switches for main circuit, field, starting, and isolating switches. The accompanying illustration (fig. 1) shows a plain lever switch (Type H) for heavy currents, 2,000 to 10,000 amperes; it is of laminated construction and is designated form L. The copper strips furnishing the contact faces on the front of the panel are carried through the panel direct to the cable socket or bus-bar

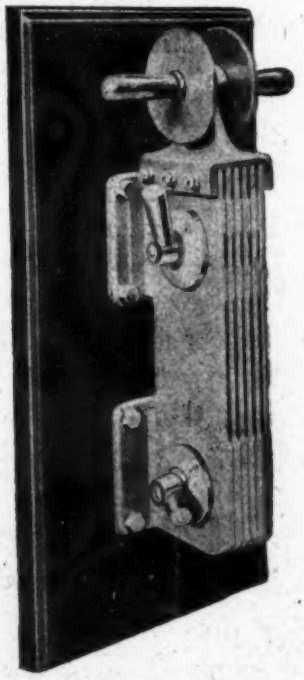


Fig. 1.—B.T.H. 10,000-amp., 250-volt, Laminated Lever Switch.

connection without the intervention of round stems and connecting nuts. These switches can be supplied for single or double-throw; they are single-pole only, and suitable for mounting on 2 in. and 2½ in. panels.

The contact surfaces are furnished with bolts and locking handles, by which they may be slackened for manual operation and tightened for carrying current. To hold the double-throw switches in the "off" position, the hinge contact bolt should be screwed up after the switch has been opened. Switches for 2,000 amps. are made with 4-in. blades for A.C. and D.C. circuits; those for 3,000, 4,000, and 5,000 amps. are constructed with either 4-in. or 6-in. blades, and are suitable for A.C. or D.C. circuits; while those for 6,000, 8,000, and 10,000 amps. are constructed with 6-in. blades only, and are suitable for D.C. circuits.

A New Electric Truck.

The Chloride Electrical Storage Co., Ltd., Clifton Junction, Manchester, is putting on the market a handy electric truck suitable for factory and warehouse use. It will carry 1 ton, and is fitted with a crane to lift 3 cwt.

Magneto Condenser Plates.

As a substitute for the mica used alternately with tinfoil to form the plates of magneto condensers—mica being at the present time very difficult to procure—Mr. F. R. Simms, in conjunction with Simms Motor Units, Ltd., has lately taken out a patent in respect of a method of insulating the tinfoil plates from one another by coating them with an enamel consisting of non-conducting material, more or less flexible, such as is sometimes used as a coating for conducting wires.

FUEL ECONOMY IN ELECTRIC POWER STATIONS.

At the last meeting of the Council of the I.M.E.A. the question of the inferior quality and reduced supplies of the coal that was used by electricity supply undertakings was discussed, and the secretary, Mr. H. Faraday Proctor, was instructed to lay before the Controller of coal mines the following matters for his consideration, and to ask whether anything could be done on the lines suggested to improve existing conditions, with a view to the better and more economical utilisation of the coal, reduction in transport, and increasing the production:—

Quality.—The slack coals that were now being supplied contained a considerably larger percentage of ash, and also a larger percentage of fine dust, than used to be the case. There was less heat value in the coal, and the amount of ash to be disposed of was greater than need be.

Additional transport was required both for coal and ash, which added to the congestion of the railways and canals, and increased the labour difficulties.

The proper consumption of the coal in the boiler furnaces was impaired, and a loss of efficiency resulted. This was one of the most serious aspects, having regard to the great shortage of electricity generating plant throughout the country. On account of the low grade of fuel supplied, the output of existing boilers was considerably reduced, and thus much more boiler plant was required to be manufactured to deal with the power demands; the cost of generation was also greatly increased due to the loss of efficiency in the boilers. A larger grate area was required, which meant the use of additional boilers, and extra labour was required for handling the increased quantities of coal and ashes, as well as for the running and upkeep of the additional boilers.

It was suggested that if greater care were exercised in getting the coal by eliminating the dirt, most of the above disadvantages would disappear; also that if all coal produced were to be crushed to a standard size, say, 2 in., the dirt would be evenly distributed amongst all users, and its effect would then hardly be felt. At present the least important users were in many cases receiving the best coals.

The large coal now being supplied for household purposes, for instance, was of the best quality having regard to its calorific value, and actually in practice a larger percentage of smalls or slack was made in the average household by the process of hand breaking than would prevail if the coal were broken by mechanical means. It was felt that if all coal were broken by machinery at the pits, and if one grade only were distributed, the percentage of slack used in the households would not be more than at present, and the electricity undertakings, who were the more important users, would be able to obtain a higher grade fuel, which would result in higher efficiency. The cost and labour involved in crushing the coal would be extremely small compared with the value of the results attained.

Reduced supplies.—The Council viewed with alarm the recent and rapid depletion of the stocks of coal held by electricity supply undertakings; in some cases the stock in hand only represented one to three days' supply, and deliveries were being still further restricted. It was in most cases impossible to discriminate between consumers engaged upon work of national importance and those who were not, and any interference must equally affect both. Supplies of electrical energy should be maintained at all costs, and it was suggested that preference in coal deliveries should be given to electrical undertakings, so that a minimum of at least three weeks' supply might be kept in stock.

The opinion was expressed by colliery managers that the present shortage could be practically met if the eight hours' day were suspended, and the men allowed to work nine-and-a-half hours a day; that would probably increase the present output by 20 per cent.

In reply to the above, Mr. D. Wilson, technical adviser to the Controller of coal mines, stated, in regard to the question of quality, that, owing to the very large number of miners who had been withdrawn from the industry for military service, and also to the greatly increased demands for fuel of all descriptions in this country, as well as by our Allies, all collieries were working under very considerable pressure. In these circumstances, it was unavoidable that a larger percentage of ash, and fine dust, should be turned out than used to be the case. The various points raised had been fully realised by the department for a very considerable time, and while pointing out the difficulty of avoiding entirely that particular trouble at the present moment, every effort was being made, and would continue to be made, to effect an improvement.

For several months now a special representative from the production department had been detailed to take up with the collieries, and also directly with the miners themselves, the question of effecting an improvement, particularly in slack fuels sent out from the various collieries, and there had already been numerous instances where, as a result of definite complaints, some improvement had been effected. One of the objects of the department was to obtain from electric power stations a monthly record of the average calorific value of the fuel they received, which would be a most valuable guide and of considerable assistance in dealing with the question of deterioration.

He was in agreement that it was inefficient to carry much of the low-grade fuel over long distances, but at the present moment the shortage of coal of all descriptions was so pronounced that it was not possible to make arrangements for only the graded and better quality fuel to be supplied. Wherever this could reasonably be done, however, suitable arrangements would be made.

The suggestion with regard to installing crushers at the various collieries was particularly interesting, but there were practical difficulties in the way of installing new machinery of any sort just now.

With regard to the general question of supply, the whole question of coal stocks at electric power stations was at the present moment under review, and every effort was being made to ensure that in the very near future at least three weeks' stock should be on hand. The importance of the electricity supply industry was very fully appreciated, and its requirements would continue to receive special consideration; at the same time it was imperative that the demands from those undertakings should be reduced to the lowest possible minimum. With regard to the suggestion respecting an increase in the working hours of miners, that was a question of high policy in which a very large number of factors had to be taken into consideration.

The Controller appreciated the interest the association was taking in this matter, and all the points raised would continue to receive his earnest consideration.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Telephone Maintenance.

Through the medium of your valuable paper, may I call the attention of British manufacturers to the value of turning out every instrument with a wiring diagram attached. During my experience I have found that the absence of wiring diagrams has been responsible for unnecessary scrapping of telephones, simply because the maintenance man would not go to the trouble of tracing out the connections, in order to obtain a complete knowledge of the working of the instrument.

The skilled telephone maintenance man at home encounters various makes and types of telephones, and in order to carry out his work efficiently, it is necessary for him to carry wiring diagrams about with him, but it frequently happens that he finds he has left them behind just when they are required. In many cases at home, and in the majority of cases abroad, the maintenance is in the hands of semi-skilled men to whom a diagram of connections would be of considerable assistance. It is surely in the interest of the manufacturer that the purchaser should be in possession of as much information as possible relative to the maintenance of the apparatus, and although to my knowledge one enterprising firm has, within recent years, turned out all its manufactures with diagrams and working instructions, the majority have persistently ignored the recommendations made by the maintenance contractor.

Within the last few days, in the East, I have rescued from the scrap heap a number of portable signalling sets of excellent, but rather complicated, design. These instruments were dispatched by the manufacturers two years ago, as an improvement on the older pattern. In the absence of any working instructions or diagrams, the engineer condemned them as "not suitable for the system," and pursued the easy policy of ordering a number of the older type, rather than spend an hour or two tracing through the mass of connections. This type of individual is one which is often encountered in the telephone world, and manufacturers assist him by withholding reasonable and time-saving information.

Telephone Engineer.

June 16th, 1918.

Trade Unions: Past, Present, and Future.

The E.T.U. has tackled with courage and vim the thousand and one problems which have risen since the beginning of the war, with a success which has staggered even the most pessimistic in the electrical trade. The general secretary of the E.T.U. has acted with keen discrimination and a strong hand in his negotiations with employers, Government officials, and the like, during the present war.

The E.T.U. claims to be, and is, a democratic body, with possibly the freest expression of opinion and action available to any trade unionist, hence the reason for the fact of men acting on their own.

"The Writer of the Article" airily quotes Mr. A. Henderson, M.P., stating "The idea that the relationship between Capital and Labour must necessarily be antagonistic must be abandoned." Quite so, but we are dealing with the cold, hard fact of the present time, and the writer's experience is antagonism from the employers' side on any question—economic, social, or moral.

The antagonism can only be abandoned when one deals with employers who know they have solid value for their money, and have the necessary experience, ability, and brains to judge the same.

When the E.T.U. has reached the desired goal of solely controlling the industry, then will it expel, or not expel, but certainly not at the employers' behest, and what is, and what is not, fair output will be decided by the E.T.U.

Some of our gallant lads are already back, and they are as keen as mustard for "the Home Front," and have asked us what we have been doing to allow D.O.R.A. and Munitions Bill to trifle with our liberties, particularly in reference to trade upion action and liberty, for which they have been fighting.

As a "student" of trade unionism, Mr. John A. Tasker appeals strongly to the writer, and his offer to take "an active and prominent part in the reconstruction of at least the trade union for electrical industries" is indeed a charitable one, but why the touching modesty as to the past of John A. Tasker?

J. W. Woolley,
Electrical Trades Union.

Whitley Bay, *August 19th*, 1918.

[This letter has been shortened.—EDS. ELEC. REV.]

Motor Problems.

With reference to your editorial in your issue of August 23rd, we enclose our List No. 304.

If you will refer to the marked paragraph on page 5 you will see that we have gone into the question of voltage rise on breaking the motor circuit, and allowed for it in rating the switches dealt with in this list.

We also enclose descriptive matter regarding our discriminating controller, and you will see, by reference to the marked paragraph on the first page, that we already practise what you preach, and supply a controller fitted with a locking coil which ensures precisely the result described in the last five lines of your article.

The device is described in conjunction with the discriminating controller, but it can be applied to any controller for any service arranged to operate on any or all of the notches.

For **George Ellison,**
J. G., *Sales Manager.*

Birmingham, *August 24th*, 1918.

[The first reference above mentioned relates to the rise of voltage experienced on breaking an inductive circuit, such as that of a stalled series motor, a brake magnet, or a field winding. Messrs. George Ellison give figures for the breaking capacity of 750-volt switches ranging up to 2,000 volts, and state that the pressure rises liable to occur with series motors (from ¼ to 35 B.H.P.) on a 500-volt circuit are calculated to amount to 550 volts, while the voltage rises in the field windings of shunt motors of similar sizes may run to from 1,600 to 23,000 volts.

The second reference is, perhaps, more directly relevant to the subject of our comments; it relates to the use of a safety coil in series with the armature of a series motor, which, when used for *lowering* a load, has the armature and field connected in parallel, as in the case of a shunt motor. The safety coil operates a detent which determines the highest notch, and therefore the maximum speed at which the load can be lowered, the speed varying inversely as the load.

These features are extremely interesting, and in this particular connection Messrs. Ellison appear to have succeeded

in attaining to the mistake-proof quality that we advocated, while they are fully alive to the importance of pressure rises in motors, &c. At the same time, we must point out that we made no reference to inductive pressure rises in magnet coils; our remarks related to excessive E.M.F.'s in armatures, due to their continued rotation in a strong magnetic field.—Eds. Elec. Rev.]

Our Friends at Ruhleben.

In view of the belief apparently held at home that technical papers no longer reach us, I beg to state that 14 copies of the 1918 Review have reached me to date (the last received being a copy of May 3rd). We regret exceedingly that by no means all the copies you have sent have arrived, but you will realise that the Technical Circle keenly appreciates every fresh item of news, and we are very grateful to you for your continued efforts to keep us in touch with the world outside.

Wm. Eric Swale,
(Hon. Sec. to Comm. of T.C. Ruhleben.)

July 19th, 1918.

Technical Instruction for British Interned in Switzerland.

Instruction Centre,
Seeburg, Lucerne.
Saturday, August 17th, 1918.

I send herewith two photographs of the shops here. Having now been here six months, I am in a position to gauge the great use and benefit these classes will be both to the individual men, the trade, and British enterprise after the war.

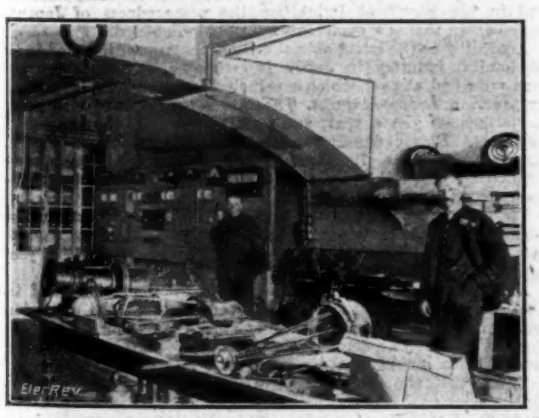
The course consists of, in the following order:—

Magnetism; wiring for bells, alarms, small telephones; wiring for light and power in tube, casing, lead-covered, and on

British Soldiers Learning Electrical Work.

insulators; running small plant; accumulator and switchboard attending; meter-reading; electrical drawing; simple lathe work, and making small instruments, galvanometers, and voltmeters.

The number of men I have had through the class is 30, who were mostly of the Old Army, and I must say the spirit



Another of the Workshops at the Instruction Centre.

they have shown here leaves no doubt as to their future success in the trade if they go into it on their return home.

Great thanks are due to Major Mitchell, C.B.E., for the placing of such an ideal place at our disposal, as well as a good deal of plant; and also to the following firms in England: Messrs. the General Electric Co., Ltd., and Mr. Hibbert, of the Regent Street Polytechnic; and in Switzerland to Messrs. Brown, Boveri & Co., Ateliers de Construction Oerlikon, Westinghouse Lamp Co., Swiss Cable Co., and Trub, Tauber & Co.

In conclusion, I may say that I think the trade will be neglecting its opportunity if it fails to give both material and financial support to so worthy a cause with such far-reaching results.

William Harris-Crisp,
Electrical Instructor.

[We are heartily glad to learn that our comrades of the incomparable "Old Army" are doing so well in Switzerland, though we would rather have them at home again. We commend the last sentence of Mr. Harris-Crisp's letter to the notice of our readers.—Eds., Elec. Rev.]

COAL CONSERVATION.

The Final Report of the Coal Conservation Committee, which was recently issued (Cd. 9,084. 1s. net), merely relates the course of procedure since the appointment of the Committee in July, 1916, as a sub-committee of the Reconstruction Committee. Sub-committees were appointed to report on the subjects respectively of Mining, Power Generation and Transmission, Metallurgy, Carbonisation, and Geology. The Carbonisation and Metallurgical Sub-committees amalgamated in January, 1917. Owing to the necessity of research and surveys, negotiations were entered into with the Department for Scientific and Industrial Research, which led to the establishment by the Government of the Fuel Research Board. The formation of a Ministry of Mines and Minerals is recommended.

In February, 1917, the Interim Report of the Geological Sub-Committee was received, and in April, 1917, that of the Power Generation Sub-committee on Electric Power Supply in Great Britain; both were immediately submitted to the Prime Minister as matters of urgency. These reports, together with those of the other sub-committees, are submitted as forming the substantive report of the committee itself.

The report on electric power supply was abstracted in our issues of January last; the other reports contain little of direct interest to electrical engineers as such. In the final report of the Mining Sub-committee, the waste of coal at collieries is commented on, and reference is made to the economy that could be effected by the development of a cheap supply of electricity in industrial areas. The loss of coal underground is also dealt with at considerable length. The increasing cost of production is discussed, and it is held that the cost will continue to be high after the abnormal conditions due to the war have passed away. Between 1906 and 1913 the output of coal per person employed underground fell from 360 to 321 tons per annum, and was less than half that obtained in the United States. The report states that it is only by increased production per head that our trade position can be maintained and that improved conditions of employment can be secured. The use of labour-saving appliances to a greater extent is advocated, and it is pointed out that there is room for considerable improvement in underground haulages in accordance with well-conceived plans and a systematic policy. Mining scholarships are recommended to assist in raising the standard of education of the workers and officials.

In the report of the Carbonisation Sub-committee the manufacture of gas is briefly discussed, but this subject being in the hands of the Fuel Research Board, is not dealt with at length. The coke industry, which is closely linked with the iron and steel industries, receives more detailed treatment; special reports have been drawn up by Prof. W. A. Bone and Mr. Ben. Talbot respectively, on the manufacture of coke for metallurgical purposes and on fuel economy in steel works, which are reproduced as appendices to the report. Prof. Bone shows that at present three-quarters of the metallurgical coke consumed in this country is made in by-product recovery ovens; in November, 1917, some 8,700 of these ovens were ready or in operation, and many more were being erected; the coke from these ovens is as satisfactory for smelting purposes as that obtained from bee-hive ovens. There is a substantial margin for economy in the fuel consumption of iron and steel works, and Mr. Talbot outlines a concrete scheme which the sub-committee regards as making out a strong case on practical as well as theoretical lines for the erection of economical "unit" works near coalfields, with shipping facilities, for steel production. With regard to fuel economy in power stations, the report indicates that the question of carbonising and gasifying coal as a preliminary to its use for steam raising is still open, pending further research on all the issues involved. The sub-committee considers that there is a definite field for the use of gas engines in special circumstances, where the most suitable units are of relatively small size—say, under 3,000 or 4,000 kw. A strong opinion is expressed in favour of the creation of a body of trained experts in order to further the use of more scientific methods for the preparation and use of fuel; whether these experts would be employed as agents

of a Government department, as agents for the manufacturers of plant, or as members of the staffs of industrial concerns is a matter left for future settlement. The Fuel Research Board hopes to be able to provide facilities for obtaining such training.

Mr. Talbot, in his report, advocates that a modern steel plant should produce from 300,000 to 500,000 tons of steel a year, and that the one establishment should comprise by-product coke ovens, blast furnaces, steel furnaces, and rolling mills, turning out finished steel sections so as to use up the surplus power and heat generated at the ovens and furnaces. He discusses the organisation of such a plant in detail, assuming that gas engines fed with blast-furnace gas will be used for driving the blowing engines and for generating electric power. With a weekly output of 6,000 tons of pig iron, the blast engines would have to be of 8,250 I.H.P., and the auxiliary power would require 1,080 KW. In the steel works the auxiliary machinery would require 535 KW. For driving the rolling mills 10,817 KW. would be needed. Various openings for economy are referred to. The author also states that the export of coal admirably suited for making the best coke should be prohibited, as it places our iron and steel industries at a disadvantage. The linking up of iron works by an electrical network would provide an additional means of economy, the surplus energy being sold to outside consumers. A possible saving of fuel aggregating 7½ million tons per annum is suggested, but to achieve this would involve the entire or partial scrapping of most of the existing works, and a large capital outlay.

WAR ITEMS.

Members of the I.E.E. and the Military Service Act, 1918.—The Council of the Institution has been in communication with the Ministry of National Service with reference to the utilisation, with due regard to their skill, of members of the institution called up for military service under the above Act. With a view to their being posted, as far as vacancies are available, to technical units, members of the new military age, on being called up for military service, are therefore invited to communicate with the Secretary of the Institution, who will supply them with the form and certificate approved by the Ministry for this purpose.

Our Letters from France.—A Major, writing from France under date August 25th, 1918, says:—

"Please accept my thanks for sending me the ELECTRICAL REVIEW during past month. Am very pleased to see that you are endeavouring to get a move on with the manufacturers as regards the pushing of British productions for after the war. As far as this country is concerned, there should be a very large market here for electrical gear of all kinds. It is sad indeed to see the valuable machinery absolutely wrecked beyond all possible repair; turbines pierced by shrapnel and hit by H.E., large three-phase generators with a big hole where a shell has gone through, switchboards merely a heap of scrap, transformers merely tangled wire. The Boche has found some of this gear very useful, inasmuch as he has transported a lot of the stuff away either for shell production, or else to fit up his wonderful underground quarters, generally well lit up, at least sixty feet below the surface. He usually takes away all bearings, &c., from the large steam engines, which are, as a general rule, of the horizontal type, and in many instances, very modern. It will take years to get this country into good shape once more, as everywhere is battered beyond all knowledge, merely tangled wreckage, so that the English manufacturers should get busy, so as to give good delivery.

"We are still as busy as ever out here, and our special type of work does not put us very much in the lime-light, so that our exploits will have to be written up *après la guerre* as we shall have plenty of time whilst waiting for jobs, which problem, it is to be hoped, the institutions will tackle, and are now making arrangements to cope with, after the war. It is to be hoped that manufacturers and other employers will realise what various phases one has been through out here, in order to assist in a small way."

Reconstruction Measures Abroad.—Firms who desire to know what their rivals, notably those in enemy States, are doing and planning, and what are the economic conditions and trading prospects in foreign countries, can now obtain two valuable War Office publications issued fortnightly, the Economic and Reconstruction Supplements to the *Daily Review of the Foreign Press*. The price of these supplements will be 6d. The Economic Supplement deals with trade and commerce, railways and shipping, banking and finance, labour conditions, social and economic policy, and legislation, &c. The Reconstruction Supplement describes the measures being taken or suggested in Germany and elsewhere in connection with the return to peace conditions. These publications will be issued by His Majesty's Stationery Office, and can be purchased through any bookseller or directly from H.M. Stationery Office.

Thyssen's War Profits.—According to the "Norddeutsche Allgemeine Zeitung," the balance-sheet of the Thyssen Steel Works at Hagendingen, which has a capital of marks 1 mill., has made a gross profit of marks 16 mill. With a capital of marks 1 mill. the total assets stand at marks 83 mill.! The Thyssen group, who own all the shares, have a balance due to them of marks 35 mill.

Trading with the Enemy.—The "London Gazette" for August 23rd contains further lists of bodies and persons in the following countries with whom trading is prohibited:—Argentine; Bolivia; Brazil; Chile; Columbia; Costa Rica; Cuba; Ecuador; Guatemala; Honduras; Mexico; Morocco; Netherlands; Netherland East Indies; Nicaragua; Peru; Salvador; Spain, and Sweden.

Exemption Applications.—At Oxford, Messrs. J. E. Elliott and Co., electrical engineers, appealed for C. J. Manley (50, grade 1), manager, and two months' temporary exemption was conceded.

Bath Tribunal has granted three months' exemption to Radcliffe Dodd (43, grade 1), employed with the Electric Tramways, Ltd.

At Cranbrook (Kent), an appeal filed by B. A. S. Rowles (48), electrician, was allowed to be withdrawn, as he has taken up work of national importance.

At Ryde, exemption until February 1st has been granted to A. F. White (27), engineer, with the Isle of Wight Electric Light Co.

At Mansfield Woodhouse, exemption was applied for G. Harling (34, grade 1), electrician with Mr. H. Rouse, the only man left, and who is working 78 hours per week. He was granted six months, and excused Volunteer serivce.

At Maidstone, six months' exemption has been granted to E. J. Freed (42, grade 3), tramway inspector with the Corporation.

At Barnes, S.W., Mr. C. S. Davidson, electrical engineer to the U.D.C., applied for exemption for A. J. Trump (47, grade B1), boiler cleaner at the electricity works. The clerk advised that the man was in the list of certified occupations, but the National Service Representative dissented. Mr. Davidson contended that Trump was a skilled labourer, and came within the list. It was decided to ask the Tribunal at Richmond-on-Thames to hear the case.

Guildford Rural Tribunal has granted two months' exemption to E. A. West (47), electrician, of Albury.

BUSINESS NOTES.

Co-operative Electric Lamp Users.—The Registrar of Friendly Societies has given notice of the cancellation, at its own request, of the registry of the Electric Lamp Users' Co-operative Society, Ltd. (Reg. No. 1,265 R., Dublin).

Japanese Electrical Trade Activity in China.—Japanese electrical engineers have an ambitious scheme for replacing the German electricians in the market in China, and, after the war, trying to contest that big commercial theatre with American and British engineers. Recently a party of Chinese business men and journalists arrived in Tokio in compliance with an invitation from the organisers of the Electrical Exhibition which took place at Uyena Park. Japanese electrical industries have so far supplied China with electric lamps, wires, and cables through their establishments at Shanghai. One of the latest of them has also the supply of these goods in sight. But the opportunity offered by the German withdrawal and the stoppage of the supply from Great Britain and America of electrical machines are now being seized on, and in the Electrical Exhibition the preparedness of Japanese engineers in this new campaign was clearly depicted.

According to the latest official census the capital invested in the mechanical industry in Japan is estimated at 180,000,000 yen (yen = 2s. 0½d. at par), which is principally represented by machine shops and rolling stock works. The total estimated value of turnovers is 300,000,000 yen a year, and no small part of the figure is in machines. Power supply and electric transportation systems number more than 700, and the capital invested amounts to 600,000,000 yen. The power generated is above 1,000,000 H.P., and the mileage of railways is upwards of 1,000 miles.

The exports from Japan of electrical lamps and apparatus are estimated at 7,300,000 yen a year, which, considering the fact that Japan was dependent entirely on foreign supplies several years ago, is regarded as showing satisfactory progress.

At the Uyena Park Exhibition almost all departments of the electrical industry and science were covered, and the exhibitors, numbering 227, included almost all the leading manufacturers. In the first department, dealing with the domestic uses of electricity, several firms exhibited their products. The second department, dealing with the electrochemical industry, showed the rapid development of this new line in Japan, showing chemical and other products of various companies. This department contained the exhibits of steel works and alkali works which have been started under the stimulating influences of the war. The third and fourth departments dealt with electrical apparatus and the modern development of communications by means of electricity. In these sections Japan-made wireless telegraph apparatus, telephone apparatus, and all kinds of apparatus are shown, their manufacturers including several big firms.—*Board of Trade Journal.*

Bankruptcy Proceedings.—J. R. Whitehouse, Golders Green, managing director of an electrical engineering company.—Release of trustee, August 16th, 1918.

Non-Ferrous Metal Industry Act.—Further names of those to whom licences have been granted under this Act appear in the *London Gazette* for August 27th.

Book Notices.—*List of Electrical Undertakings in India.* Calcutta: Supt. Government Printing, India. Pp. vi. + 64. Price Rs. 4 or 6s.—This statistical return has been compiled in the office of the electrical adviser to the Government of India, Mr. J. W. Meares, and is corrected up to 1916-17. Small installations have been omitted. Part I deals with public supply undertakings, which number about 28, having a total installed capacity of 104,270 KW., total connected load 129,531 KW., and an output of 154 million units sold per annum. Of the total load connected, private lighting and fans account for 57,000 KW., traction for 7,000 KW., and other power uses for 64,000 KW. The generating plant comprises 6,713 KW. D.C. and 97,557 KW. A.C.; 48,703 KW. is driven by steam, 1,942 KW. by oil, and 53,625 KW. by water power; The total number of consumers is 37,260, and the total output 154 million units sold. Part II shows that there are six tramway undertakings, carrying 126 million passengers per annum, with 14 million car-miles. Part III deals with private electrical installations over 200 KW., which aggregate 80,317 KW., used mainly for power. Part IV relates to undertakings in Native States, aggregating 26,210 KW. of plant, and having a total output of 103 million units per annum. This is nearly all A.C.

In all, the generating plant capacity amounts to 215,400 KW., mainly A.C., of which 129,400 KW. is driven by steam and 78,000 KW. by water; the total load connected is 235,000 KW., and the total units generated are about 500 millions per annum. Small factories, &c., under 200 KW. would probably add 18,000 KW. and 40 million units per annum.

Financial and technical details are given of a number of undertakings concerned. Notwithstanding an editorial reference to cost and shortage of paper, at least thrice as much of that precious material is used as would have amply served to contain the data, many pages being practically blank and others "sparsely populated." The plant, we are pleased to notice, is mainly of British origin. The tables will be of great use to exporting firms, who are constantly inquiring of us as to the voltage and frequency of supply of foreign undertakings.

Statistical Report of Electric Undertakings in Japan. Tokio, Japan: Direction General of Electric Exploitations, Department of Communications. Pp. iv. + 20.—This report gives data of undertakings of various descriptions, which total 2,617, of which 1,195 are operated by water power, 854 by steam, and 568 by gas; 2,445 stations have a capacity less than 1,000 KW., 1,717 of these being below 50 KW.; 25 are over 10,000 KW. Of 546 undertakings of which the ownership is stated, 26 are owned by municipalities and 499 by joint-stock companies. Classified with regard to motive power, the hydro-electric stations have a plant capacity of 424,247 KW.; steam, 252,599; gas, 26,329; total, 703,175 KW. Hydro-electric generating stations number 363; steam, 133; gas, 135; total, 631. Presumably many of the undertakings take bulk supply from others, as there is a very great disparity between the number of undertakings and the number of generating stations tabulated. Other tables relate to the length of electric lines and number of supports; mileage of tramways (1,368 miles single track) and number of cars (total 4,492); number of lamps connected (average 18 lamps of 135 C.P., or 362 watts, per 100 of population); number of motors, &c., connected (total motors 466,335 KW., other appliances 78,183 KW.); power supply to industries (625,286 H.P.); tariffs; capital, revenue, expenditure, &c.; and progress tables, from 1903 to 1916, in which period the total KW. capacity has increased from 44,252 to 805,289 and the capital invested from £180,000 to 11 millions sterling.

Metals and Alloys. London: *The Metal Industry.* Price 5s. net.—This is a set of tables containing the percentage composition and other particulars of over 500 metals and non-ferrous alloys; the data include particulars of all the known metals, breaking strengths, specific resistances, specifications of bronze and brass castings, melting and boiling points of metals, electrochemical equivalents, and data relating to Admiralty alloys.

Bradford Engineering Society: Journal of Proceedings.—Although the Society has been established since 1899, this is the first occasion on which its proceedings have been recorded in the form of a journal. Judging by the contents of this volume of some 140 pages, the lack of a permanent record of the previous proceedings has been a distinct loss to our technical literature; we congratulate the Society on its excellent work during the Session 1916-17, and cordially endorse the Editors' hope "that this volume will be the first of a long series of useful publications." Amongst other papers which it contains are the following:—"Some Modern Developments in Steam Engine Practice," by Mr. W. Eastwood; "Submarines," by Prof. G. F. Charnock; "Principles of Continuous Current Motor Starters," by Mr. W. Howard Brown: "Testing of Steam Plant," by Mr. R. K. Derbyshire; "Economical Steam Raising," by Mr. C. E. Stromeyer; "Economical Working of the Boiler House," by Mr. W. Holehouse; and "Rope Driving," by Mr. E. Hart. In these papers there is a store of valuable information, and we have no doubt that the Journal will be a source of added strength to the Society, and profit to its members.

The Place and Importance of Science in Education. By Ed. C. Reed. From the author.—In this address, held before the "Association for the Scientific Development of Industry," Manchester, the author urges the importance of taking the current while it serves, and forestalling any possible reaction, by incorporating in our educational system a proper course of training in science and scientific methods.

The British Scientific Products Exhibition. Pp. xxiii + 236. London: The British Science Guild. Price 2s. 6d. net.—The descriptive catalogue of the Exhibition organised by the British Science Guild, and held at King's College, Strand (August 12th to September 7th), is a publication possessing permanent value. It is not merely useful as a guide to, and souvenir of, the Exhibition, but is an authoritative record of the development of products and appliances of scientific and industrial interest which prior to the war were obtained chiefly from enemy countries, but which are now being produced in the United Kingdom. Apart from the descriptive notes on the products exhibited, there are highly interesting and instructive articles dealing with recent developments in the various branches of industry, contributed by the leading authorities in their respective spheres. As only a limited number of catalogues has been printed, early application should be made for copies.

Trade Announcements.—Mr. George Boorman has removed from Stamford Street, S.E., to 38, Brooke Street, Holborn, E.C. 1. Telephone: "Central 11610."

We learn from Mr. Herbert H. Berry that he has purchased from Messrs. Ferranti, Ltd., of Hollinwood, Lancs., the whole of the patents, stock, and tools in connection with their electric heating and cooking business. Mr. Berry has transferred the whole of this heating and cooking business to the Jackson Electric Stove Co., Ltd., of 38, Blandford Street, W., who will continue to deal with all inquiries and orders arising therefrom. Mr. Berry has acquired an interest in, and has been appointed a director of, the Jackson Electric Stove Co.

Messrs. "Lamlok," of 36, Rusthall Avenue, Chiswick, announce that they have disposed of the sole manufacturing and selling rights in the Lamlok Adjustable-cord Grip Patent 10,423/17 to the Edison Swan Electric Co., of Ponders End.

F.B.I.—The Federation of British Industries has invested a further £50,000 in National War Loan.

Catalogues and Lists.—Messrs. Broom & Wade, Ltd., High Wycombe.—Catalogue No. 11, of 24 pages, containing full illustrated information respecting Hyatt roller bearings as applied to cranes, trucks, and transportation appliances generally; also particulars of load capacities, limits of measurements, directions for installation and lubrication, lists of installations, &c. Copies may be obtained on application.

Vislok, Ltd., 3, St. Bride's House, Salisbury Square, E.C. 4.—List of users of Vislok safety lock nuts.

Liquidations.—British Telegraph Instrument Co., Ltd.—In voluntary liquidation. Liquidator, Mr. J. H. Webb, 4, Ruskin Walk, Herne Hill, London, S.E.

Frictionless Bearing Metal Co., Ltd.—A petition for winding up this company has been presented to the Court by M. Harris & Son, Ltd., judgment creditors, and it is to be heard on October 15th.

LIGHTING AND POWER NOTES.

Armadale.—Mains Extensions.—The Scottish Central Electric Power Co. is erecting an overhead cable through Armadale for the purpose of connecting several public works.

Carrickmacross (Co. Monaghan).—E.L. Charges.—On the E.L. Co. tendering for the supply of electricity during the winter season at 10d. per unit, members of the U.D.C. objected, on the ground that the charge for private lighting was 8d. per unit, and a deputation has been appointed to wait on the company.

Continental.—Switzerland.—A new company has been formed under the name Schweizerische Kraftübertragung, A.-G. für Verwertung und Vermittlung von Elektrizitäts. This is a fusion of the North-East Swiss and the Berne generating stations, with the object of making it possible to utilise the stations of the two companies to the fullest extent. The networks of the two undertakings are to be connected by a high-tension line at 100,000 volts. This line will have the further advantage that other supply stations within reach will be able to draw energy from, or supply energy to, the combined network. The interconnection of the system will provide a common network over the principal areas of Switzerland.—*Elektroindustrie*, May 15th.

Sweden.—The Alglunds Elektriska Kraft Aktiebolag is a new undertaking which has lately been formed at Anaset to undertake the supply of electrical energy for lighting and power purposes in the Alglund district. Another new concern is the Burlidenskraft-stations Aktiebolag, organised in Burliden for a similar purpose. In both cases the capital is relatively small.

Dunfermline.—Price Increase.—The Fife Tramway, Light, and Power Co. has increased its charges for electricity for power and lighting by a further 16⅔ per cent., making 50 per cent. over pre-war prices.

Glasgow.—Sub-stations.—In view of the early completion of the new power station at Dalmarnock, a Committee has been appointed to report on the necessity of additional and enlarged sub-stations.

Huddersfield.—Price Increase.—From the end of September the T.C. has decided to increase the charges for electricity by a further 12½ per cent., making 50 per cent. over pre-war charges.

Kingswinford.—Price Increase.—The Midland Electric Co. has raised the price of electricity to the U.D.C. by a further 35 per cent., making an advance of 75 per cent. over pre-war rates.

London.—Islington.—Year's Working.—The annual accounts of the electricity undertaking for the year ending March 31st last, show capital expenditure of £591,779, an increase of £13,839; income, £87,339, an increase of £5,252; expenditure, £55,147, an increase of £4,018; gross profit, £32,192, an increase of £1,234; net profit, £2,522, an increase of £449. The units sold numbered 9,554,210 (public lighting, 1037,440; private, 2,378,014), a decrease of 90,038; average price obtained, 2·29d.; cost per unit sold, 2·03d. The number of consumers was 3,863; load factor, 17·94; maximum load, 6,077 K.V.A.; and the capacity of plant, 9,800 KW.

Maidstone.—Year's Working.—The report of the Corporation electricity undertaking for the year ending March 31st shows a net surplus for the year of £745. The sales for lighting only account for 7·24 per cent. of the total sales; average total cost per unit sold was 1·53d., against 1·52d. last year, and the average revenue was 1·66d., against 1·69d. Total capital expended was £110,518, an increase of £4,409, and that outstanding was £54,534, against £60,890. Total capital charges were £7,285, an increase of £197; total revenue £26,630, an increase of £3,894; total costs £18,600, an increase of £4,237; and gross profit £8,030, a decrease of £244. Number of units sold was 3,866,684, an increase of 629,943; number of consumers connected 1,133, an increase of 41; maximum load recorded 1,643 KW., an increase of 397 KW.; and load factor 32·8 per cent., against 29·6 per cent. The units sold were:—Private lighting 306,711, a decrease of 7,012: public lighting 34,941, an increase of 21,487; power 2,963,529, an increase of 528,496; traction 354,937, an increase of 17,955; heating 164,916, an increase of 57,762; and cooking 41,650, an increase of 11,155. Hitherto the supply has been low-pressure D.C.; but during the year the Committee decided to install high-tension, three-phase, A.C. plant. The contracts already placed include one 30,000-lb. water-tube boiler with superheater and mechanical stokers; one 1,500-KW. Ljungstrom turbo-alternator with condensing plant and auxiliaries; E.H.T. and L.T. switchgear; one 1,000-KW. rotary converter; E.H.T. cable, and a new balancer of 100 KW. capacity.

Oldham.—Wages.—In accordance with the award of the Committee on Production, the Electricity Committee has granted its employés who are members of the E.T.U. an increase of 3s. 6d. per week.

South Africa.—According to *U.S. Commerce Reports*, electricity has come into extensive use in South Africa for lighting and power purposes, especially in the Transvaal. Apart from the power generated at the mines, 836,437,817 KW.-hours were supplied during 1916 by the various stations of corporations and municipalities and by the public-supply companies in the Union. Of the total, 784,847,599 KW.-hours were alternating-current, of which 783,689,784 KW.-hours were used for lighting and power, and 1,157,815 KW.-hours were converted into direct current for tramways. In the mines and industries of the Transvaal, Cape Province, Orange Free State, and Natal there are in use 782 direct-current generators having a total capacity of 65,039 KW., 240 alternating-current generators of an aggregate capacity of 255,697 KW., 4,367 direct-current motors having a total capacity of 85,347 H.P., and 7,377 alternating-current motors totalling 462,848 H.P. capacity.

Southend.—Price Increase.—From the next reading of the meters, the T.C. has increased the charges for electricity for lighting, power, and tramways by 15 per cent.; consumers by contract have been given three months' notice of the increase. No more slot-meter consumers are to supplied at present.

Stirling.—Price Increase.—The T.C. has increased the charges by 1½d. per unit for private lighting, and by 2d. per unit to slot-meter consumers—making the present price 7d. per unit in each case.

Welshpool.—E.L. Scheme.—The T.C. proposes to appoint a Sub-Committee to consider an electric lighting scheme.

TRAMWAY AND RAILWAY NOTES.

Aberdeen.—Food Delivery Service.—The Corporation Tramways Committee proposes to extend the present facilities for carrying parcels to include the delivery of bread and meat from shops, by means of messengers who would leave the cars at certain points.

Accrington.—Year's Working.—The total income of the Corporation tramway department for the past year amounted to £36,791, an increase of £5,360 compared with the preceding year, and the expenditure was £33,451, an increase of £2,020. The gross profit of £3,340 compares with a deficit of £977 in the previous year. Debt repayment amounted to £4,073, interest to £4,782, and income-tax to £554; £4,558 has been transferred from the borough funds to the tramway account since the inauguration of the system. The depreciation and renewals fund stands at £19,606.

Australia.—Melbourne.—Control of Tramways.—A deputation which waited on the Minister of Public Works to discuss the question of the control of the tramway undertaking was informed that the accumulated profits (approaching £500,000) must not be used for the reduction of the rates, that the tramways must submit to some restrictions, and that, as they compete with the railways, they must contribute £50,000 per annum to the Government, which is the estimated loss caused to the railways through tramway competition. These proposals are not acceptable to the municipalities concerned.

Sydney.—New Cars.—A new style of tramcar is being constructed by the tramway department, and has so far been found satisfactory. The car is of the "Dreadnought" type, the top is entirely covered in (instead of the ends being covered with canvas blinds), and the trucks are made lighter, so that the cars can run coupled together. If the public trials are satisfactory, this style of car will probably be adopted as a standard pattern for the whole of the N.S.W. tramway system.

Bath and Weston-super-Mare.—Strike.—The women employés who have been on strike have been given the 5s. per week bonus which they demanded.

Croydon.—The Ministry of Munitions has issued a certificate placing the Corporation tramways under the Munitions Act. It is explained that this has nothing to do with the strike, and is the result of prolonged negotiation. The Sunday morning service has been resumed.

Dewsbury and Spen Valley.—Fare Revision.—The Heavy Woollen District Electric Tramways Co. has increased the original 1d. fares to 1½d., and reduced the number of cars in service.

Electric Vehicle Progress.—Sheffield Corporation has approved of an arrangement whereby two British-built electric chassis are to be purchased instead of those on order.

In consequence of the increased cost of coal, Walsall Corporation has raised the price of energy for electric vehicle battery-charging by 20 per cent.

Glasgow.—Wages.—The Tramways Committee has refused to grant applications for the following increases in wages: Traffic and other male staff, women drivers, conductors, and other grades, £1 per week over pre-war rates; male drivers, conductors, semi-skilled workers, and labourers, 3s. 6d. per week.

Ilford.—Strike.—Owing to the strike of women employés the Council tramway service ceased work last week; but with the help of members of the staff, several cars were run for the convenience of workmen. Mr. Harvey, tramway manager, and Mr. Owen Walters, chairman of the Tramways Committee, acted as driver and conductor respectively several times last week.

Keighley.—Railless Traction.—Owing to the difficulty of effecting repairs to the motors of the cars, two of the railless services have been discontinued.

Leeds.—The suggestion of the B. of T. Tramways Committee that employers of labour should arrange various times for starting and finishing work and for meal times, in order to relieve the congestion of traffic on the tramways, has not met with any encouraging response. The employers have not yet replied to the suggestions, and representatives of the workpeople say they are not prepared to accept any alteration unless accompanied by a scheme of shorter hours.

London.—Traffic Obstructors Fined.—Fines of £2, with costs, were imposed at a police court recently on each of two defendants for being the owners of vehicles which, owing to their defective condition, broke down and caused an obstruction to the traffic on the L.C.C. tramways.

Highgate.—Runaway Tramcar.—A tramcar which got out of control on Monday was pulled up by another car pursuing it, from which a chain was thrown and fastened to the runaway. What might have been a serious accident was thus averted, but a police officer who helped in the feat was seriously injured and is in hospital.

Strike.—The women strikers on the tramways and omnibuses resumed work on Friday, last week, pending the decision of the Committee on Production on the following points:—Whether Clause 14 of the award of July 9th is intended to nullify any previous awards; equal total payments for women and men for equal work; the present change of payments to date from July 9th, and future changes to take place conjointly for men and women.

In the Provinces generally work was resumed on the same day. In the case of the Southend Corporation undertaking, the employés refused to take the cars out on Thursday morning, but on the Corporation agreeing to pay the 5s. per week increase the usual services were running by 10 a.m.

As the result of a meeting on Friday night, about 1,000 employés of the underground railways, male and female, ceased work on Saturday morning. The lines chiefly affected were the Piccadilly and Brompton, Hampstead and Highgate, Bakerloo, and City and South London. The strike was not authorised by the National

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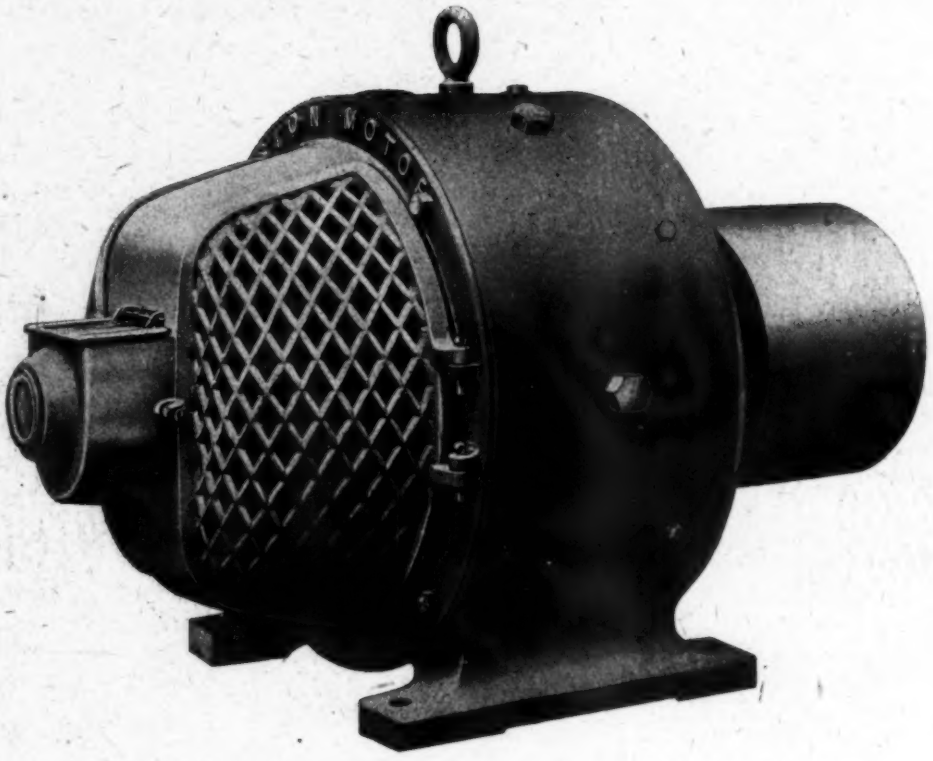

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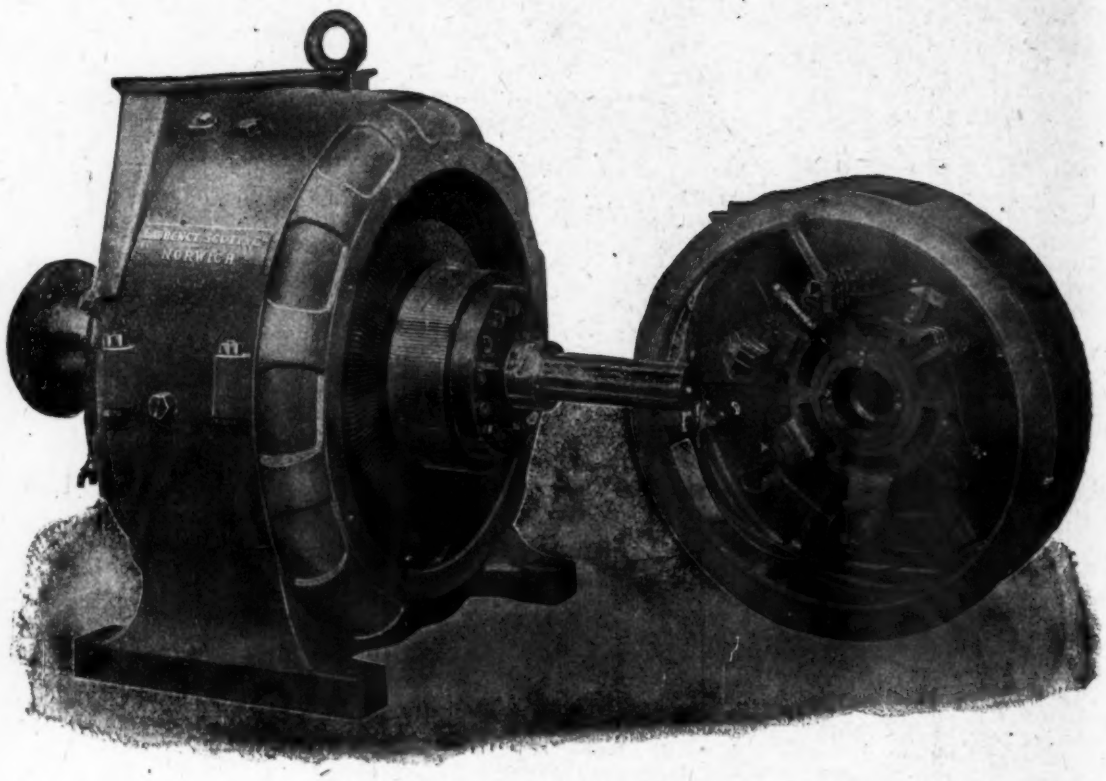

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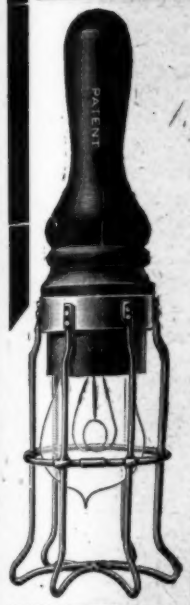

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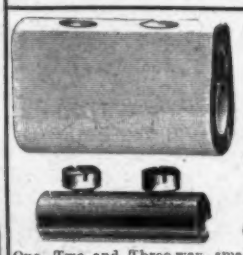

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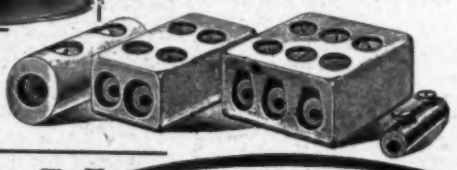

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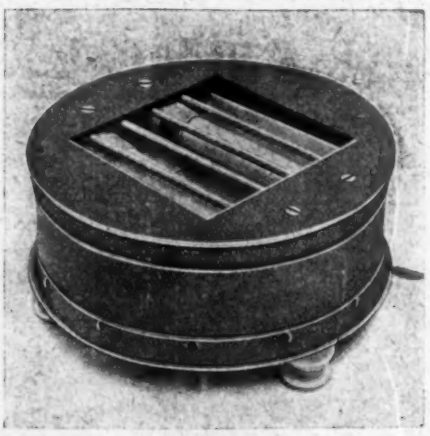

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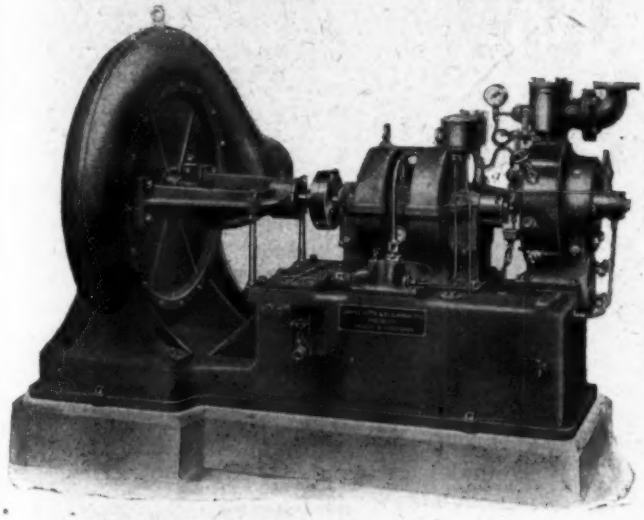

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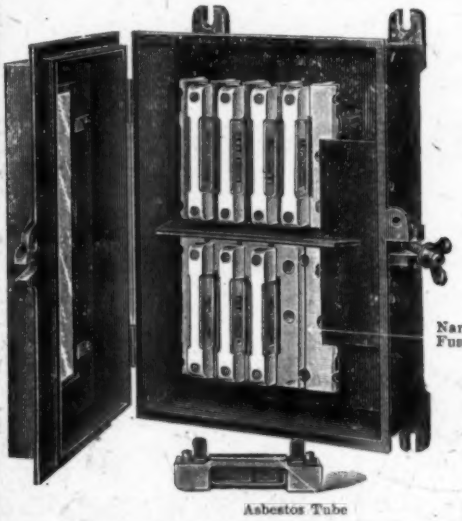

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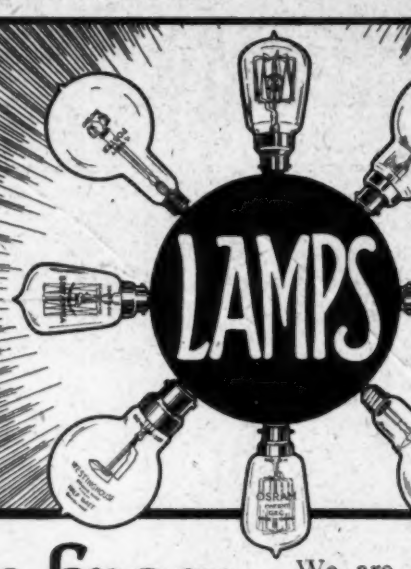

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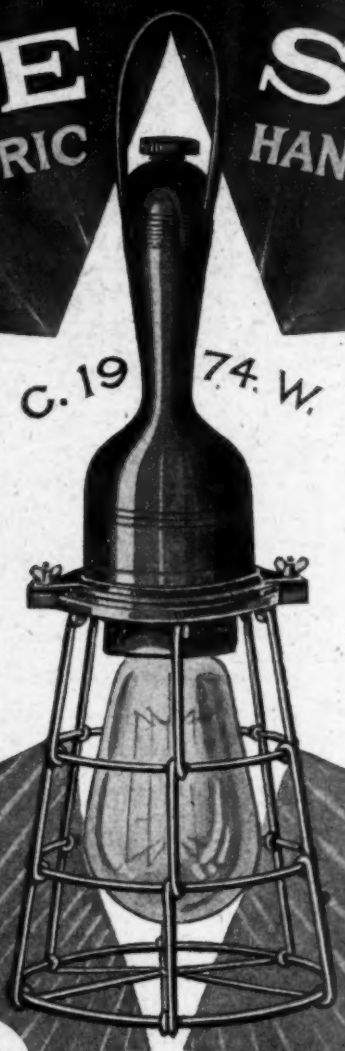

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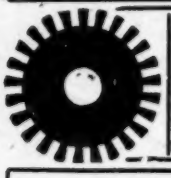
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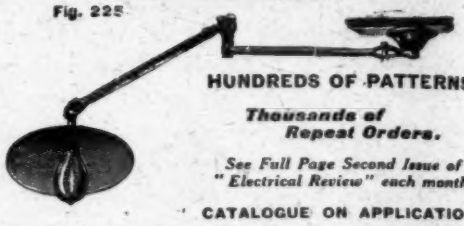
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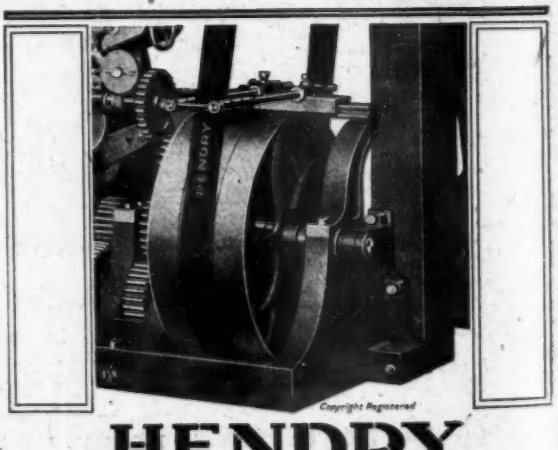

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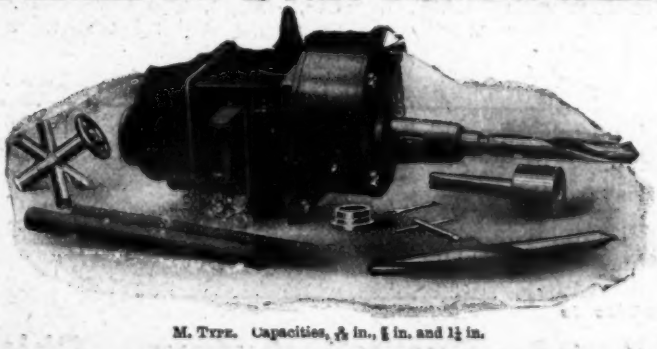

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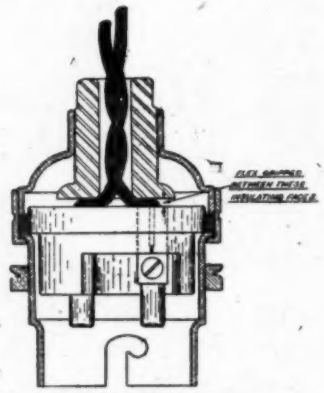
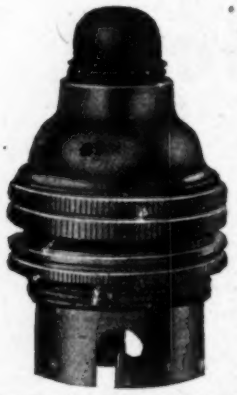


Showing the Grip in use with a THIN FLEXIBLE.



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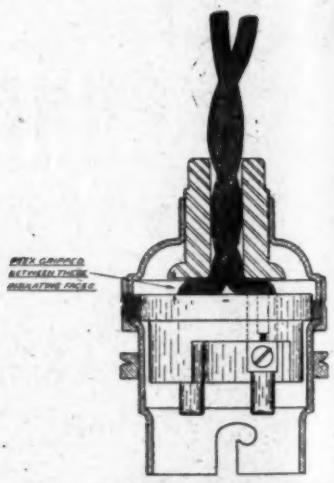

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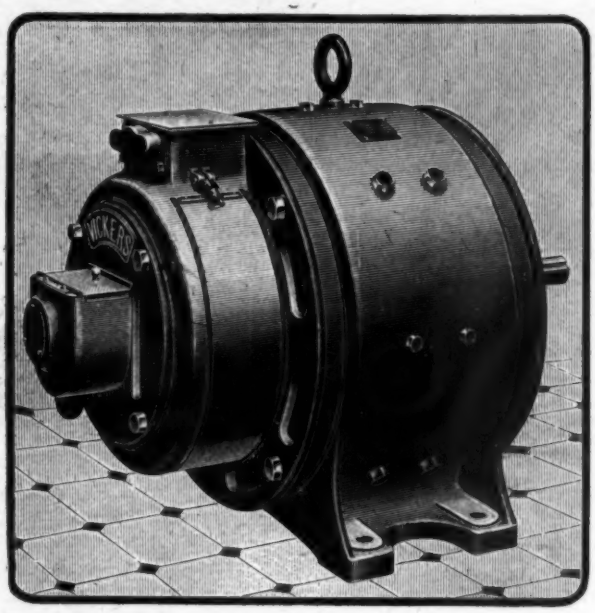

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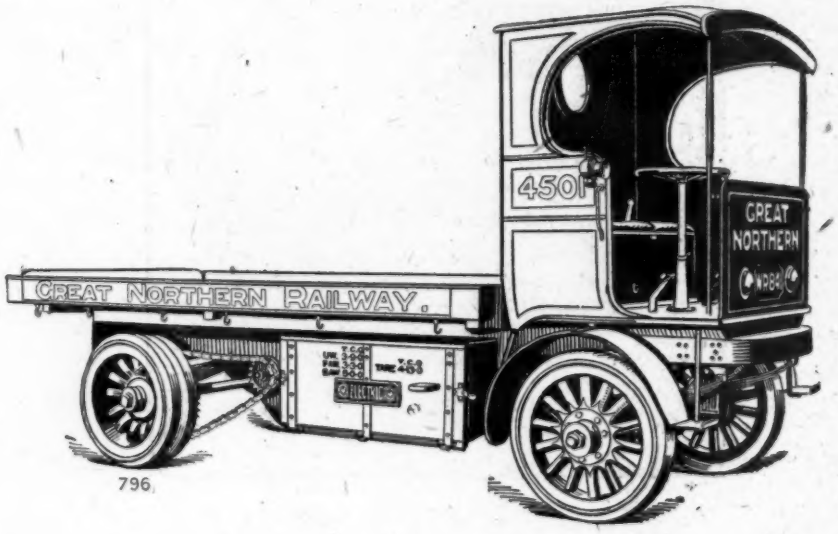

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LONDON OFFICE: 39, VICTORIA STREET, S.W.1

THE "ELECTRICAL REVIEW"

CHEAP PREPAID ADVERTISEMENTS

Relating to Situations Vacant, Situations Wanted, Businesses Wanted, Businesses for Sale, Patents for Sale, Specific Articles of any kind Wanted, or for Sale or Exchange, are inserted at the rate of ONE PENNY per Word (minimum 1s.). Box Number and "Electrical Review" Address count as Seven Words.

LATEST TIME FOR RECEIVING 9.30 a.m. THURSDAYS.

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AUCTIONEERS

and VALUERS of

Electrical Works, Plant and Stock.

WHEATLEY KIRK, PRICE & CO.

(Established 1850).

46, Watling Street, London, E.C. — 16, Albert Square, Manchester.

26, Collingwood Street, Newcastle-on-Tyne.

SITUATIONS VACANT.

Latest time for receiving 9.30 a.m. Thursday.

If letters are not to be delivered to certain firms or individuals (if known), instructions to that effect should be sent to the Manager of the ELECTRICAL REVIEW, who will do his best to carry out such instructions. Letters of applicants cannot in such cases be returned to them, nor can the names of Advertisers using a number in any way be disclosed.

Original Testimonials should never be sent.

ASSISTANT CHARGE ENGINEER.

ASSISTANT CHARGE ENGINEER wanted. Applicants should have had mechanical and electrical training, and experience in the operation of D.C., H.T. and E.H.T. supplies.

Wages £2 10s. per week, plus 20s., plus 12½%.

Apply, stating age and experience, to ENGINEER AND MANAGER, West Ham Corporation Electric Supply, 84, Romford Road, Stratford, E. 15. 2305

SITUATIONS VACANT.—*Continued.*

ADMIRALTY.

Department of Electrical Engineering.

WOMEN TRACERS required, with experience in tracing drawings of electrical machinery, control gear, switchgear, or general electrical installation work.

Applications, giving details of experience, stating age and salary required, and forwarding copies of recent testimonials, should be sent to DIRECTOR OF ELECTRICAL ENGINEERING, Admiralty, Great George Street, London, S.W. 1. 2108

COUNTY BOROUGH OF WOLVERHAMPON EDUCATION COMMITTEE.

Science and Technical School.

WANTED, Visiting Lecturer and Demonstrator in Electrical Engineering (alternating and continuous), three evenings per week, September to April. Forms of application (which must be returned not later than MONDAY, 2nd SEPTEMBER, 1918) may be obtained on sending a stamped and addressed envelope to the SECRETARY, Education Offices, Town Hall, Wolverhampton. 2426

SHIFT ENGINEER.

WANTED, Shift Engineer experienced in E.H.T. 3-phase and L.T. supply; preference given to one who is experienced in Boiler House Economy. Salary £156 to £175 per annum, including all bonuses, according to experience.

Apply, stating age and enclosing copies of recent testimonials, to WILLIAM C. BEXON, Engineer and Manager, Electricity Works, Kilmarnock. 2441

SHIFT ENGINEER.

SHIFT ENGINEER wanted for certified undertaking. Must have good experience with Steam Plant and E.H.T. Rotary Converting Plant, and proper technical training. Salary £192 per annum inclusive for all time worked.

Apply stating particulars of age, training, &c., and copies of recent testimonials, to 2321, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CHARGE ENGINEER.

CHARGE ENGINEER wanted for Certified Undertaking; turbines and water-tube boilers. Salary £3 7s. 6d. per week.

Apply, with full particulars, stating age (not less than 26), experience, &c., to—

THE BOROUGH ELECTRICAL ENGINEER,
Electricity Works, Bedford. 2410

LEITH CORPORATION ELECTRICITY DEPARTMENT.

SWITCHBOARD ATTENDANT for D.C. general supply and traction switchboards. Wages 43s. 6d., plus 12½%, for seven 8-hour shifts.—Apply, stating age, particulars of experience, to BURGH ELECTRICAL ENGINEER, Leith. 2430

(*Continued on next page.*)

SITUATIONS VACANT.—*Continued.*

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three Consecutive Insertions for the price of two, if ordered and prepaid with first insertion.
Box Number and ELECTRICAL REVIEW address count as seven words.

A VACANCY occurs with a London Firm of Engineers for an energetic outside Representative, preferably with a connection among the large hotels, clubs, and associations in the West End. Good salary and commission to the right man. No person resident more than 10 miles away, or already on Government work, will be engaged.—2409, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ARMATURE Winder required for D.C. repairs in the Midlands (Controlled Works). No person already employed on Government work will be engaged.—Apply, stating age, experience, and wages for 53-hour week, to your nearest EMPLOYMENT EXCHANGE, mentioning No. A5940. 2442

ARMATURE Winder wanted for repair work in East London. No one residing more than 10 miles distant, or at present on Government work, need apply.—5403, ELECTRICAL REVIEW, 4, Ludgate Hill, London

ARMATURE Winders, used to D.C. and A.C. repairs and rewinds. also switchboard and controller hands. No person already employed on Government work will be engaged.—Apply to your nearest EMPLOYMENT EXCHANGE, mentioning No. A5944. 2457

ARMATURE Winders, used to repair shop, D.C. work. No person resident more than 10 miles away, or already on Government work, will be engaged.—Apply H. D. & S., 32, Newington Causeway, S.E. 1686

ASSISTANT Engineer, wanted for London central station, salary, including bonus, £259 and residence.—Full particulars, to 5353, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ASSISTANT Engineer wanted for small undertaking; capable of executing repairs on consumers' premises and mains work. Knowledge of Diesel engines preferred. Salary £150. Must be low category.—2318, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ASSISTANT Estimating Engineer required immediately for control gear sales department, electric engineering work. South Coast.—Apply, stating age, qualifications, and salary required, to 2399, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CABLE Jointer (first-class), required for E.H.T. and L.T. cables.—Apply, stating age, experience, wages required, &c., to THE SCOTTISH CENTRAL ELECTRIC POWER CO., Kirk Wynd, Falkirk. 2315

CALIBRATORS for moving coil and moving iron instruments. Good wages. Write stating experience and salary required. North London district. Men on Government work, or over 10 miles distant, need not apply.—2322, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CAPABLE Test Room Assistant wanted. Experience with contactor gear an advantage but not essential, good prospects if suitable. No person already on Government work will be engaged. —Apply, giving full particulars of experience and wages required, to your nearest EMPLOYMENT EXCHANGE, mentioning No. A5824. 2265

DRAUGHTSMAN, with experience in the design of Switchgear. Progressive permanent position for the right man. Discharged man preferred. No one already on Government work, or living over 10 miles from Charing Cross, need apply.—State experience, salary and age, to 2379, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DRAUGHTSMEN wanted, preferably used to H.T. and L.T. switchboard work; London district. No person resident more than 10 miles away, or already on Government work, will be engaged.—2368, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRIC Motor Mechanic, experienced in repairs to small motors; permanent progressive job for the right man. State age, experience and wages required. No person resident more than 10 miles away, or already on Government work, will be engaged.—2256, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRIC Vehicle Garage and Battery Depôt (London).—Several young men are required as assistants on all classes of vehicle battery work. Technical knowledge and experience in electrical work is desirable, and opportunities will be afforded to qualify as outdoor battery inspectors. Commencing wages at the rate of 38s. per week, plus 3s. war bonus, plus 12½ per cent., for a 50-hour week. An Electrician with an all-round experience, including accumulators and machines (D.C. and A.C.), is also required as Working Foreman; rate 1s. 3d. per hour, plus 3s. war bonus, plus 12½ per cent. No person resident more than 10 miles away, or already employed on Government work, will be engaged.—2317, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SITUATIONS VACANT.—*Continued.*

ELECTRICAL Fitter wanted used to central-station switchgear and repair work; standard rate of wages.—Apply, with full particulars of experience, stating age, and enclose copies of testimonials, to NORTHAMPTON ELECTRIC LIGHT & POWER CO., LTD. 2423

ELECTRICAL Wireman wanted (Warrington district); only first-class man for screwed, tubing and general work. Manchester rate. Give full particulars of previous employment. Government work. No person already employed on Government work will be engaged.—Apply to your nearest EMPLOYMENT EXCHANGE, mentioning No A5896. 2373

ELECTRICAL Wiremen and Switchboard Attendants, required for a large Controlled Works power house in the Midlands. No person already employed on Government work will be engaged. —Apply, stating age, experience, and wages required for 53-hour week, to your nearest EMPLOYMENT EXCHANGE, mentioning No. A5939. 2444

ENGINE Drivers for private power station. Experience of Belliss engines and refrigerating plant preferred. Fitter for private power station. Experience of Belliss engines preferred. Constant employment for suitable men.—2453, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER wanted to take charge of small country town installation (south coast) oil and gas engines, battery, underground and overhead mains, 150 consumers, about 40-KW. maximum load. Wages 56s. per week, including bonuses.—Apply, stating age and experience, to E. LL. INGRAM, St. Osmund's Road, Parkstone, Dorset. 5429

EXPERIENCED Foreman or Forewoman required to take charge of flashing and mounting department, carbon filaments. No person resident more than 10 miles away, or already on Government work, will be engaged.—9728, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FITTER-Driver required for 1,000-KW. D.C. Power Station in Government Controlled Establishment. Must have good experience with Corliss engines and Lancashire Boilers. Permanent situation to qualified and capable man. No person already on Government work will be engaged.—Applicants are requested to give full particulars of apprenticeship, training, experience and wages required, to their nearest EMPLOYMENT EXCHANGE, quoting reference No. A5903. 2387

GLASSWORKERS wanted, male or female, used to repairing electric lamps, or with any experience in the manufacture of metal filament lamps; constant work, good wages. No person resident more than 10 miles away, or already on Government work, will be engaged.—2402, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

IMPROVER required for three-wire D.C. station (Certified Undertaking), must have good theoretical training.—Apply, stating age, experience, salary required.—ENGINEER AND MANAGER, Electricity Works, Leek, Staffs. 2380

IMPROVER wanted for 3-wire D.C. Corporation electrical works. —Apply in first instance, stating age, experience and salary required, together with copies of testimonials, to 2448, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

JUNIOR Shift Engineer required in combined A.C. and D.C. station. Salary £175 per annum inclusive.—Apply, stating age and experience, to BOROUGH ELECTRICAL ENGINEER, Electricity Works, Dover. 2432

LIFT Engineering. An old-established London firm, manufacturing electric lifts, have opening for energetic young man with thorough technical and commercial experience of lift business, with view to partnership. No person resident more than 10 miles away, or already on Government work, will be engaged.—In first place, write fully, in strict confidence, to E. S. DAVIDSON, Atlantic House, Holborn Viaduct, E.C. 2407

LONDON power house requires a Lad to train for switchboard. Age not less than 16 years. Some technical knowledge essential. Splendid opportunity for willing learner. Wage, inclusive, over 30s. to commence.—5397, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

MECHANICAL Foreman Fitter required for London suburban power station. Must have good experience with Belliss engines and water-tube boilers.—Applications, which will be treated in strict confidence, should give particulars of training, experience and wages required, to 2439, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

OVERHEAD Linesman.—Apply, stating age, experience and wages required, MANAGER, Birkenhead Tramways. 2366

(Continued on next page.)

SITUATIONS VACANT.—*Continued.*

QUALIFIED Meter Testers required. No person on Government work, or living more than 10 miles away, engaged.—Apply, stating age, experience and wages required, to THE ELECTRICAL APPARATUS CO., LTD., Vauxhall Works, South Lambeth Road, London, S.W. 8. 5394

SHIFT Engineer required for three-wire D.C. and H.T. A.C. certified establishment; wages including all bonuses 62s. per week.—Apply stating age and experience, 2451, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SHIFT Engineer wanted by certified undertaking in the North of England; wages, including all bonuses, from £3 7s. 6d. to £3 15s., according to qualifications.—Applications, with copies of not more than two recent testimonials, to be sent in to 2420, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SHIFT Engineer wanted by large progressive firm; must have good experience of steam plant and three-phase, with sound technical training; salary £200 per year, inclusive for all time worked.—Apply, stating particulars of age, experience, &c., to 2421, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SHIFT Engineer wanted, 3-wire, D.C., station with battery. Certified undertaking. Babcock & Wilcox boilers and turbine experience preferred.—Apply, stating qualifications, age, medical category and wages required, to MANAGING ENGINEER, Banbury and District Electric Supply Co., Ltd., Banbury. 2302

STOKER wanted for electricity works (certified undertaking) near London; wages 59s. per week, inclusive of war bonus and 12½%.—2433, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SWITCHBOARD Attendant for power station near London. Experienced with D.C. 3-wire plant and batteries.—State union rate of wages required, age, theoretical and mechanical training, military category, with copies of testimonials, to 5419, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SWITCHBOARD Attendant wanted for Central Station.—State age, wages required and full particulars of training, &c., and enclosing copies of testimonials, to 2447, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SWITCHBOARD Driver for D.C. station (certified undertaking), gas and Diesel engines.—Apply, stating experience and wages required, ENGINEER AND MANAGER, Electricity Works, Leek, Staffs. 2382

TEST-ROOM Assistants wanted, conversant with motor-control gear or electricity meters. No person resident more than 10 miles away, or already on Government work, will be engaged.—Apply, stating age, experience and wages required, to THE ELECTRICAL APPARATUS CO., LTD., Vauxhall Works, South Lambeth Road, London, S.W. 8. 5393

TWO Engine Drivers and Motor Attendants wanted to take alternate shifts at munition factory near London, accustomed to maintenance of motors, lighting and 'phones of large factory plant; constant job to right men; usual bonus and overtime rates paid. No person resident more than 10 miles away, or already on Government work, will be engaged.—Apply, with full particulars, to 2422, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

TWO Switchboard Attendants required by large steel works, power station in Manchester area; good wages for suitable men. No person already employed on Government work will be engaged.—Apply your nearest EMPLOYMENT EXCHANGE, quoting No. A5931. 2419

WANTED, Assistant for Purchasing Department of engineering works, experienced correspondent with knowledge of materials and routine. No person already on Government work need apply.—Apply stating age, experience and salary required, to your nearest EMPLOYMENT EXCHANGE, quoting No. A5854. 2301

WANTED at once for London station, Fitter with turbine and general station experience. Standard rates of pay.—2436, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, by a firm in the S.E. district engaged on munition work, first-class Telegraph Mechanics. No person resident more than 10 miles away, or already engaged on Government work, will be engaged.—State age and experience to 6125, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, by a firm of electrical engineers in London district, first-class Book-keeper-typist; preference given to discharged man. No person resident more than 10 miles away, or already on Government work, will be engaged.—Please reply, stating age, wages and full details of experience, 2438, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Charge-Engineer for 550-KW. D.C. station; no night work; every other Sunday off.—State wages required to ELECTRIC SUPPLY CO., Wellingborough. 2458

WANTED, Draughtsman in South Coast town, for electrical instrument work; state age, experience and salary.—Replies to Box 400, Willings, 125, Strand, London, W.C. 2. 2415

SITUATIONS VACANT.—*Continued.*

WANTED, Engineer to take local charge of certified electric supply undertaking distributing bulk supply; must have experience of mains, meters and rotaries.—Apply to DISTRICT ENGINEER, Electricity Works, Dumbarton. 2405

WANTED, experienced Diesel Engine Drivers; also Shift Engineers, with knowledge of A.C. and D.C. station work; men willing to train for above should also apply.—ELECTRICITY WORKS, Leatherhead. 5383

WANTED, General Assistant to Works Manager in an old-established electric lamp factory. Good opening and progressive salary. No person already on Government work will be engaged.—Apply your nearest EMPLOYMENT EXCHANGE, mentioning No. A5667. 2037

WANTED immediately, Cable Jointer for high-tension and low-tension paper-insulated Cables. Must be capable of doing own plumbing. Wages 73s. 2d. for 52½ hours, including all bonuses and allowances.—ST. HELENS CORPORATION ELECTRIC SUPPLY DEPARTMENT, Electric Power Station, Carlton Street, St. Helens. 2400

WANTED in the power house of a large Controlled Works in the Midlands, a good Fitter for engine and general plant repairs. Must be used to a lathe. No person already employed on Government work will be engaged.—Apply, stating age, experience and wages required, to your nearest EMPLOYMENT EXCHANGE, mentioning No. A5941. 2443

WANTED Man, with good knowledge of electric lighting materials, fittings, &c., requires to be tactful, of good address, and to have knowledge of purchasing markets; discharged soldier preferred. No person resident more than 10 miles away, or already on Government work, will be engaged.—State age, experience, and salary expected, 2431, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED on a Scottish Power Company (Certified Undertaking), a Shift Engineer with good mechanical and electrical training. Good wages to a man thoroughly experienced in E.H.T. 3-phase work and boiler house control.—Reply giving full particulars, with copies of references, to 1975, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, skilled Switchboard Attendant for high-tension rotary sub-station. Wage for 56-hour week, including all bonuses, £3 10s. 6d.—Applications, giving particulars of experience and when duties can be commenced, to the GENERAL MANAGER, Corporation Electricity Department, Dunning Street, Sunderland. 2446

WANTED, Wireman for permanency, used to all best class work. No person already employed on Government work will be engaged.—Apply to your nearest EMPLOYMENT EXCHANGE, mentioning No. A5934. 5428

WIREMAN wanted, permanency, electricity undertaking in the Midlands; rate 1s. 3d. per hour, including all bonuses.—Reply, stating age and experience, to 2450, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WORKS Manager wanted, must have good experience in accurate production of parts on Capstans, Milling Machines, Presses, &c., for electrical parts in brass and insulating materials. Salary for really good man, £450 with prospects of increase. No person already on Government work, or living more than 10 miles away, engaged.—Replies in confidence, stating experience, to 2386, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SITUATIONS WANTED.

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A YOUNG man desires re-engagement with an electric supply Co., within the area of London and district undertakings, as branch manager or some permanent responsible position. Excellent testimonials; 10 years' experience.—5423, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ADVERTISER, Engineer and Manager, Electric Lighting and Power Station, desires change. 16 years' experience in erection and maintenance of plant and mains, and accustomed to the control of men. Commencing salary £260.—5334, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ADVERTISER seeks change, thoroughly experienced in estimating, preparing lay-out, buying, and generally supervising Admiralty and Mercantile ship installations, also power and lighting ashore; Government work on Clyde preferred.—5328, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

(Continued on next page.)

SITUATIONS WANTED.—*Continued.*

ADVERTISER seeks responsible position, extensive skilled, practical, technical, and commercial experience; formerly managing engineer leading London contractors; also own business; over military age. £220; eminent references.—5418, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ADVERTISER, with considerable experience in lift and crane erection and repair; would join another in repair business. Could provide small capital and find work.—5388, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

AN Assistant Manager desires change, as manager, or estimating and supervising; long and varied experience both inside and outside, keen buyer.—5420, ELECTRICAL REVIEW, 4, Ludgate Hill, London

ARMATURE Winder seeks situation, A.C. and D.C., used to all types of breakdown work.—5411, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ASSISTANT Commercial Manager, 14 years' general supply station and contracting experience, desires post progressive firm. Ineligible, energetic, highest refs. — 5311, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CHARGE-Engineer (electrician) desires change, steam, Diesel, lighting, power, plant maintenance. — 5426, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CHIEF Clerk (ineligible), many years electricity and tramway undertaking; also varied accountancy and costing experience, including motor-bus department, desires change.—5331, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CONTRACTORS' Electrical Engineer, eight years' experience in low-tension and extra-high-tension cable laying and overhead line contracts; well up in power installation work in mills, and lighting distritbuions for camps; can handle large gangs of men, and get contracts through against time.—5405, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DRAUGHTSMAN, with experience in E.H.T. and D.C. gear, desires position as assistant estimating engineer or leading position in D.O. — 5401, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DRAUGHTSMAN, 24 (neutral), desires change; dynamos, motors, switchboards, controlling gear, and testing experience. London district preferred. — 5398, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL and Mechanical Engineer, specialising in electro-plating, is free to accept responsible position where such knowledge can be utilised. Would lay-out and supervise erection and operation of plant for quantitative production.—5379, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL and Mechanical Engineer (45) shortly disengaged, desires responsible position. 28 years works' experience, technical and practical; positions held: works manager, chief electrical engineer, chief draughtsman, &c. — 5421, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer (Grade III) first-class theoretical training; eleven years' practical experience in manufacture, test room and installation of electrical machinery requires post.—5369, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer (three years' active service, commissioned R.E.), desires post in South Wales shipping. 18 years on docks and Railways.— 5425, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICIAN, *ex* R.E., charge or otherwise. First-class mechanic; 30 years' all-round experience; age 48.—C., 24, Vorley Road, N. 19. 5415

ELECTRICIAN, maintenance, good all-round hand, electric lifts, cranes, motors, rotaries; ineligible.—5389, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICIAN, nine years' power station experience, D.C. supply, experienced in batteries, dynamos, wiring, &c.; thoroughly conversant with steam and internal combustion engines; West Country preferred; army discharge final.— 5361, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICIAN seeks situation, all-round, wiring, motors, gas and oil engines.—H. J. E., 15, Gascony Avenue, High Road, Kilburn, 5390

ELECTRICIAN wants work of national importance; Grade 3, age 38; power station preferred. — 5295, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER, electrical and mechanical (44), ineligible (deafness), 25 years' experience technical, contracting, station, mains (E.H.T. and L.T.). Charge small station or mains work.—5309, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER, electrical, desires position; thoroughly acquainted with all classes of work: shipbuilding, Admiralty and War Office work.—3, Wellesley Road, Ilford, Essex. 5416

SITUATIONS WANTED.—*Continued.*

ENGINEER, Electrical and Mechanical, seeks a change; doing own alterations, own erecting. Charge of large works; 22 years' experience. A reliable all-round, practical mechanic. Work of National importance; London or suburbs.—5410, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER Electrician (ineligible) desires charge of private installation.—5402, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER Electrician or Handyman seeks employment of National importance (50), medical category 2. — 5400, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER-Electrician, seeks employment in controlled establishment; 10 years D.C. supply stations, 13 years mains, motors and lighting, two years seagoing engineer and control of men; age 39. Wages £4, plus 12 per cent. for 56-hour week.—5417, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER, mechanical and electrical training, contracting, central station and works experience, desires responsible post. Resident engineer or assistant. Salary £200—£250. References. —A. GOING, 49, Rosedale Road, Forest Gate, E. 7. 5330

ENGINEER (26), four years' college training (with degrees), good all-round experience, specialist in switchgear, and discharged from the Army (commissioned rank), wants post as estimating engineer or similar post.—5433, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FIRST-class Armature Winder, 12 years' experience of A.C. and D.C. machine winding, seeks good employment. N.E. London.—5406, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOREMAN-Electrician, practical, with good business training and more than average ability and energy, desires position of trust with prospects, estimating, buying, control of men, &c.; must be war work.—5312, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

LAD (16), considerable experience in wiring, seeks situation as wireman's mate.—5298, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

MAN seeks position as Electrician's Mate, in large works preferred. General knowledge D.C. and A.C.—G. HAYWARD, 15, Pakenham Street, Mount Pleasant, W.C. 1. 5414

MANAGER or Foreman, Electrician-Engineer; power, plant traction, wiring, distribution, estimating, &c. Over 20 years' experience.—5437, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

PROGRESSIVE position as Draughtsman-Designer on electrical accessories work. State approximate salary offered.—5404, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SWITCHBOARD Attendant, three years' experience in D.C. 3-wire switchboards, also gas and steam plants.—5427, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WIREMAN-Electrician wants job, private plant or factory.—R., 10, Myddleton Buildings, High Street, Islington, N. 5412

YOUTH (16) wishes to gain experience in switchboard work.—5385, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

AGENCIES.

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.).
Box Number and ELECTRICAL REVIEW address count as seven words.

A FIRM of Manufacturers specialising in A.C. motors require Representatives to open Sales Offices in the following centres: Glasgow, Manchester, Birmingham, and Bristol.—State experience and remuneration required; replies treated as strictly confidential. —2417, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR SALE.

COUNTY BOROUGH OF SALFORD.

THE Electricity Department have for sale two 1,000-KW. direct-current Turbo-Generators, Willans disc and drum type, coupled to Siemens machines, voltage 440-490. Rated output 1,000 kilowatts, with 160 lbs. steam pressure. The sets are in regular commission, practically new, and can be seen in operation, by appointment. Full particulars from the BOROUGH ELECTRICAL ENGINEER, Electricity Works, Frederick Road, Salford. Tenders are invited by 12 noon, MONDAY, SEPTEMBER 2nd, 1918.

L. C. EVANS, *Town Clerk.* 2370

(Continued on next page.)

FOR SALE.—*Continued.*

FOR SALE.

Delivery from Stock.

110 VOLTS.

3 3-H.P. Motors, Shunt, 1350 revs.
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6 2-H.P. Shunt Motors, 1300 revs.
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1 20-H.P. Slip Ring, 1430 revs.

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(Continued on next page.)

FOR SALE.—*Continued.*

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(Continued on next page.)

FOR SALE.—*Continued.*

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Quantity.				
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1,050	...	220 ,,	...	50 ,,
750	...	230 ,,	...	32 ,,
48	...	240 ,,	...	25 ,,
48	...	240 ,,	...	50 ,,
1,250	...	250 ,,	...	32 ,,
48	...	250 ,,	...	50 ,,

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(Continued on next page.)

ARTICLES WANTED.—*Continued.*

OLD Electric Lamps that have had wire-drawn tungsten filaments in them previously wanted, glass parts intact. Agent's price 2d. each.—847, Harrow Road, London, N.W. 10. 4932

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WANTED, Accumulator Switchboard for 27 cells, with ammeter and voltmeter, charge and discharge switch, auto cut-out, house and dynamo switch and fuses. Hotpoint "El Cooko" and electric vacuum cleaners.—E. O. WALKER & Co., 26, Cannon Street, Manchester. 2428

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WANTED, Motor-Generator, 460 volts D.C. Motor Side, 60 to 70 volts, 90 to 100 amps. Generator Side, with starter.—5386, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Megger Set or Ohmmeter and Generator, 500 volts. Lowest price.—5413, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, one compound high-speed vertical Steam Engine direct coupled to D.C. Generator, 220-volt; engine to be suitable for steam pressure 110 to 150 lb.; output required, 50 to 60 KW. Set must be complete with all accessories, and absolutely first-class condition and make. State maker, date and full particulars of plant, also price f.o.r.—5281, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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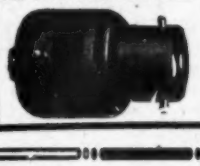

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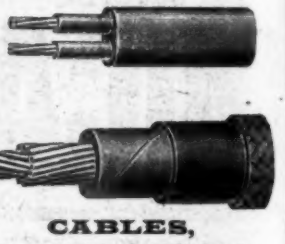

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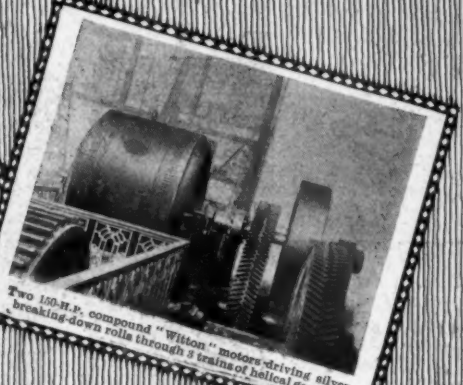

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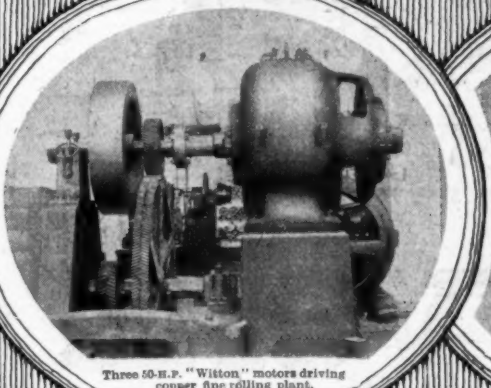

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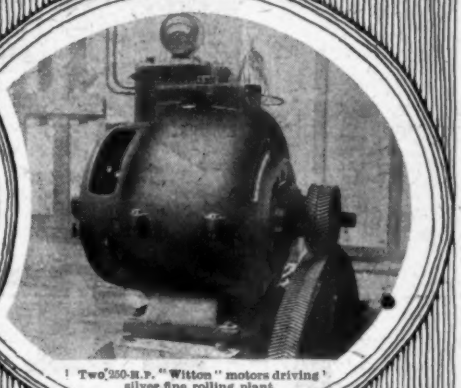

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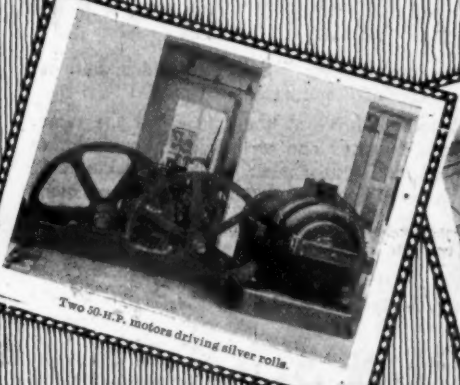

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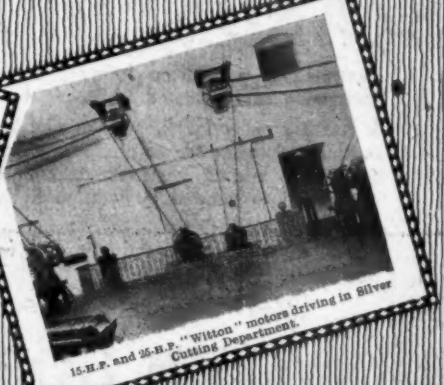

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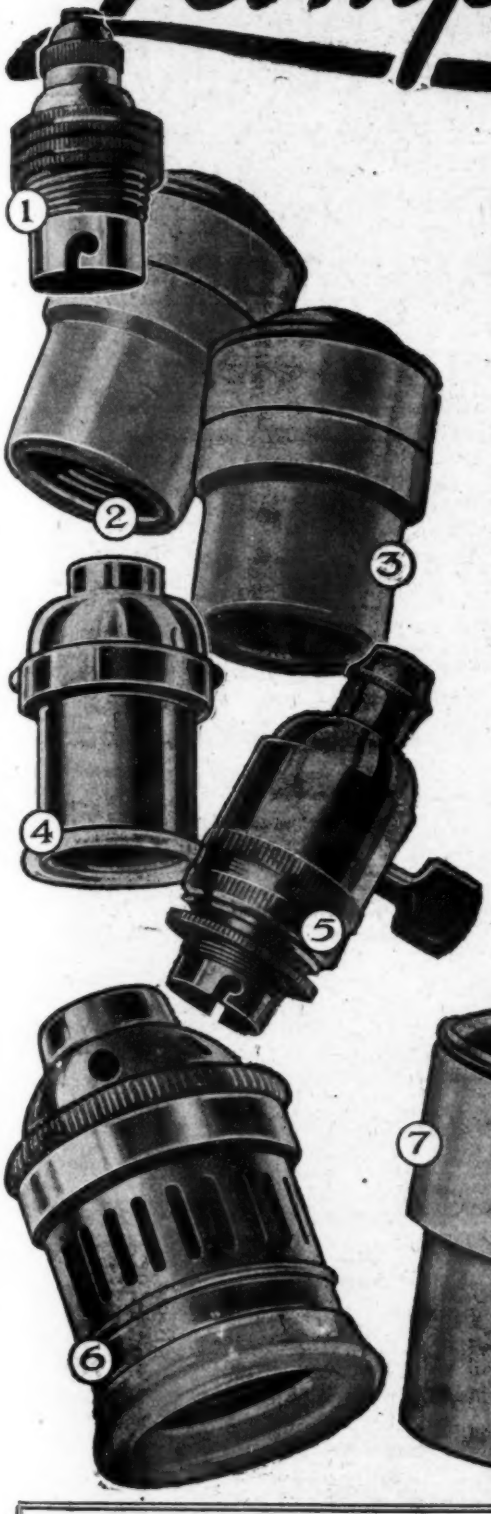
SUPPLIED IN TWO TYPES: LOW VOLTAGE (80 to 130 V.) and HIGH VOLTAGE (200 to 250 V.).

BENJAMIN ELECTRIC, LTD., Brantwood Works, Tariff Road, Northumberland Park, Tottenham, N.17.

B T-H Lamp-holders

for all types of lamps.



Here are illustrations of some of the lamp-holders you can obtain from Mazda House:—

1. Standard English B.C. holder made of heavy gauge brass—well finished with reliable plungers.
2. Best English porcelain E.S. holder—watertight—heavy current carrying parts—approved by the Admiralty and War Office.
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4. Well finished brass E.S. Holder—heavily constructed.
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6. The most reliable Goliath holder on the market—well ventilated—very heavy current-carrying parts—heavy English Porcelain interior—reliable spring contact.

7 & 8. Porcelain Goliath holders of great weight and strength. Should be used where specifications are severe. Made to Admiralty specifications.

Deliveries can be made from stock of these and many other patterns.

THE BRITISH THOMSON-HOUSTON Co., Ltd.,
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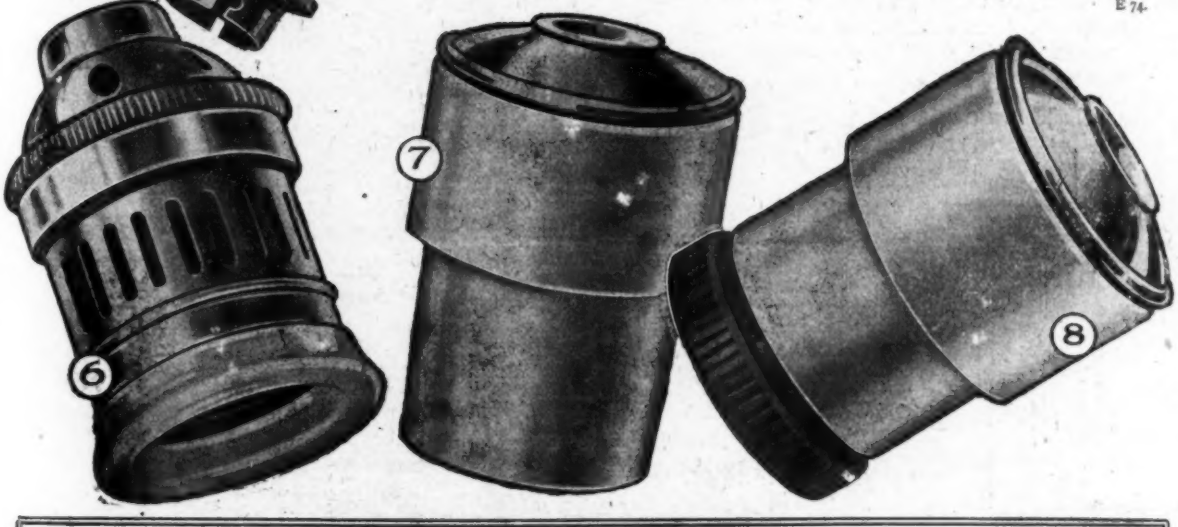

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We are Specialists in Good Lighting. We design and make Scientific Lighting Appliances and Fittings as well as the Lamps. Lighting Advice and Plans on request.

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Contractors to the Principal Railway Companies.

PHOSPHOR BRONZE and GUN METAL

in Castings, Sheets, Tubes, Rods, Wire.

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BRASS CONDENSER TUBES

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Well-Finished Brass Stand

READING LAMP

(16½" HIGH),

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Ditto, assorted Fancy Finish,

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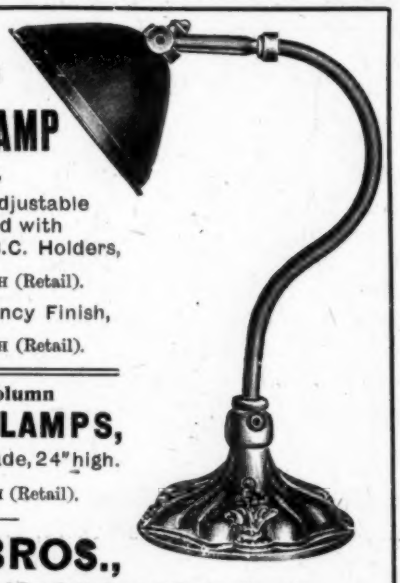

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READING LAMPS,

with Carrier for Shade, 24" high.

35/- EACH (Retail).

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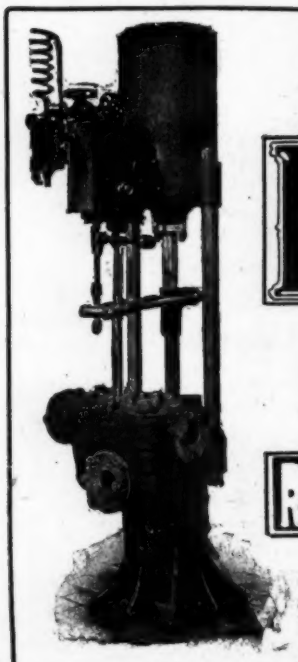

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Single & Compound

The Great Success of the Hall Pump

IS DUE TO ITS

RELIABILITY! SIMPLICITY! ECONOMY!

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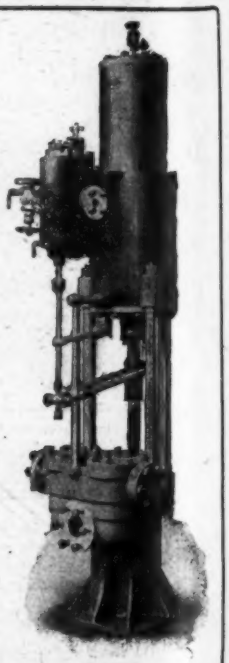

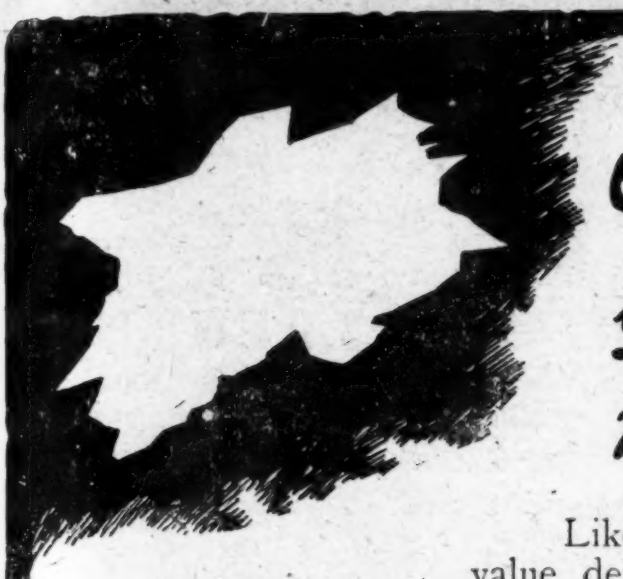

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Like other raw material its value depends on the skill with which it is utilised.

Besides making Electric Lamps that give the utmost light for the lowest current consumption, we have perfected the art of utilising that light to the best advantage.

We have designed a range of scientific lighting appliances and fittings which make electric lighting more effective, more economical and better in every way.

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BRITISH MADE IN RUGBY, ENGLAND.

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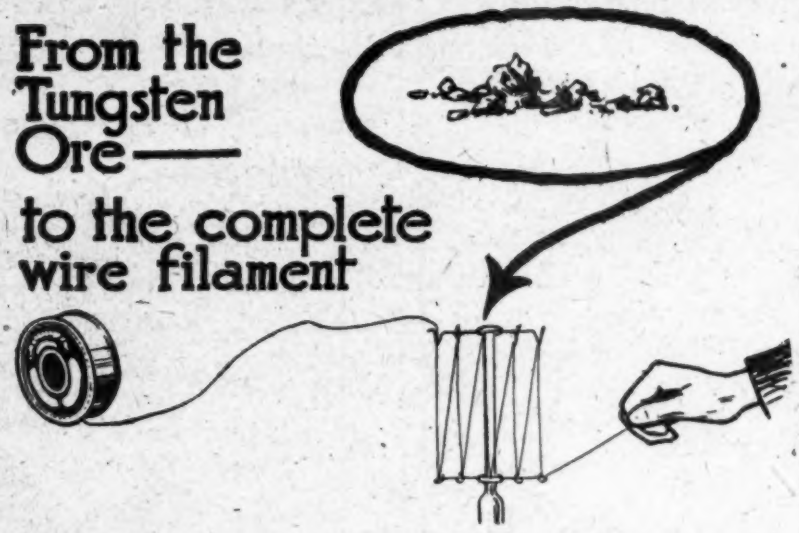

Process by process the work is carried out by British labour in our London Works. We do not buy the Tungsten Powder or the Tungsten Rod.

We begin with the Ore, refine and reduce it, work it into rod, swage it down, and finally draw down into the finest filaments.

We are Tungsten and Molybdenum experts.

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"Pladuram" Wire

which is the only sure guarantee of a British product from start to finish.

Duram Ltd

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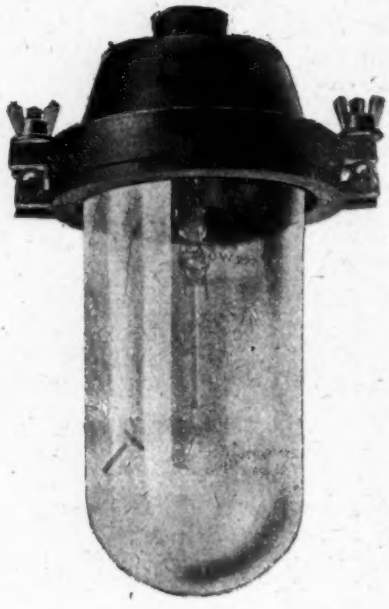
Deep Water-Tight Lanterns

Tapped to receive ¾" down drop or bracket arm.



The new pattern illustrated is cast with a deep recess in the top into which the lampholder goes.

The deep cast body and standard well glass make a pleasing well-balanced combination and avoids the necessity of stocking extra deep well glasses.

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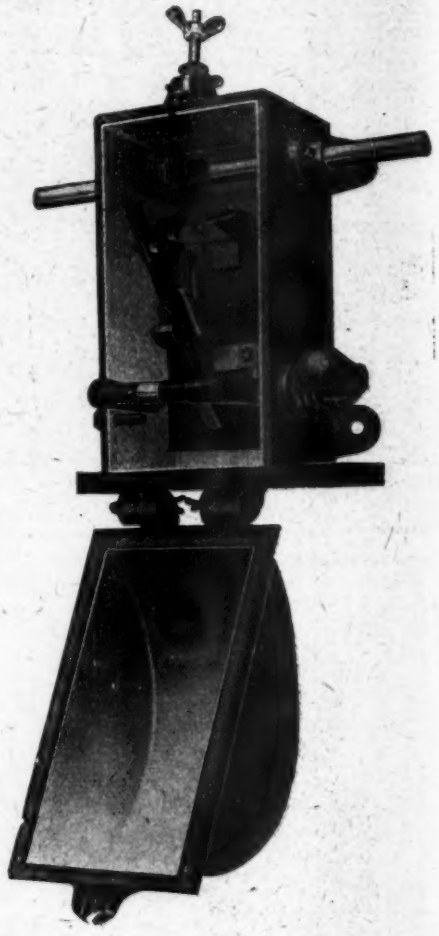

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We supply the Trade with :—

SWITCHBOARDS,
FUSEBOARDS,
SWITCH AND FUSE GEAR,
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FOR ALL PURPOSES.

Established 1832.

WE HOLD LARGE STOCKS OF BRITISH MADE INSULATORS.

Ward & Goldstone
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SYNCHRONISING
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AS INCLUDED IN OUR
SWITCHGEAR SCHEMES.

EVERY DETAIL RECEIVES CAREFUL ATTENTION.

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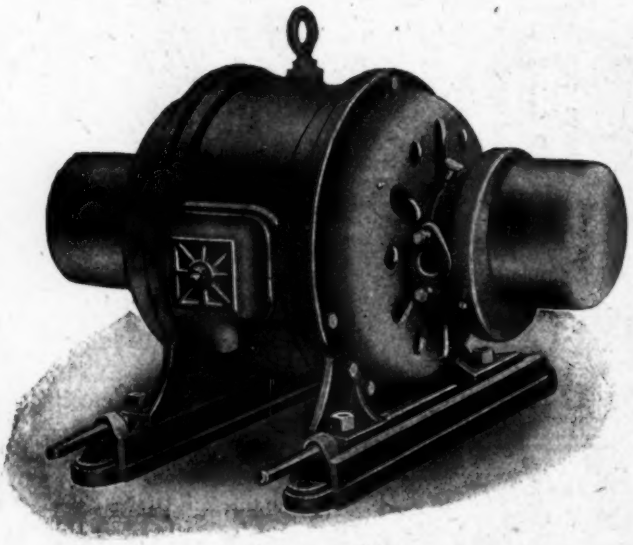
TWO FAMOUS BROOKS

Ye Brooke of Tennyson ~

which goes on and on for ever and hath a world-wide reputation—

and



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The Makers of the Motors with the world-wide reputation. . .

J. P. HALL & Co., LTD.
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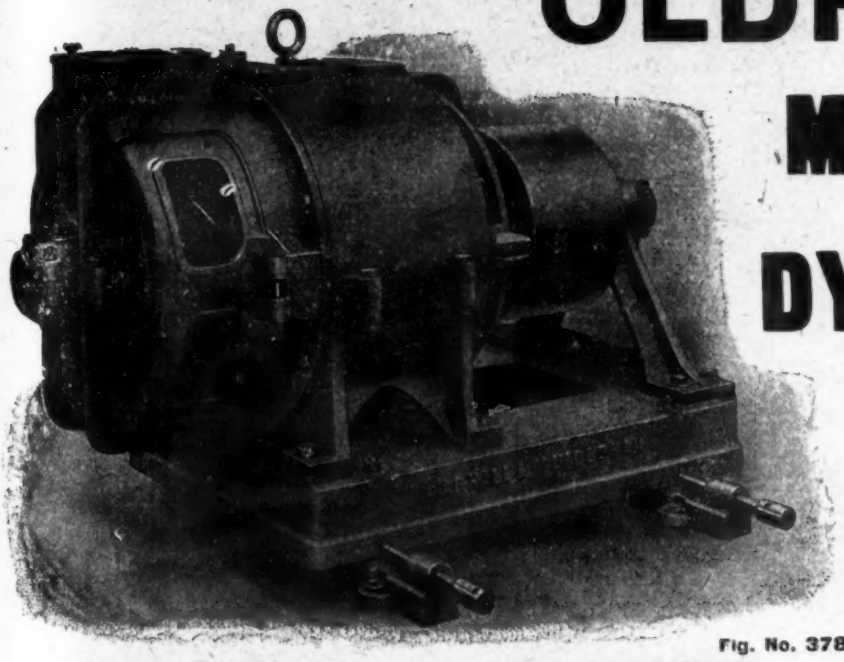
Telegrams: "DYNAMO," OLDHAM.
Telephone: 300 (two lines).



MOTORS AND DYNAMOS

FOR

Direct or Alternating Current.

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Fig. No. 378.
50-H.P. D.C. MOTOR WITH BEDPLATE AND OUTER BEARING.

GRAHAM *and* LATHAM, LTD.

ENGINEERS,
Electrical Apparatus Makers,
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Turning, Fitting, Assembling,
PATTERN MAKERS,
Casters in Ferrous and Non-Ferrous Alloys,
REPETITION TURNING ON CAPSTAN AND SCREW-CUTTING LATHES,
Light Wrought Ironwork, Cutting, Bending, Drilling, Tapping and Rivetting.

27, LOTS ROAD, CHELSEA, S.W. 10.
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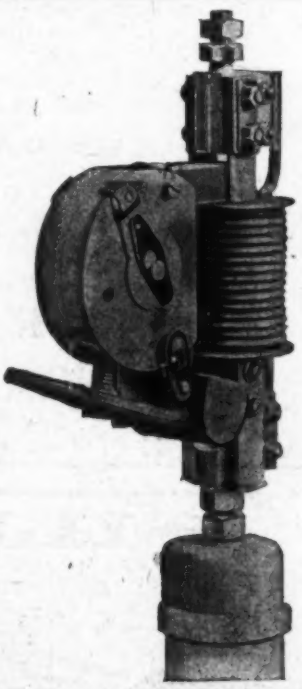
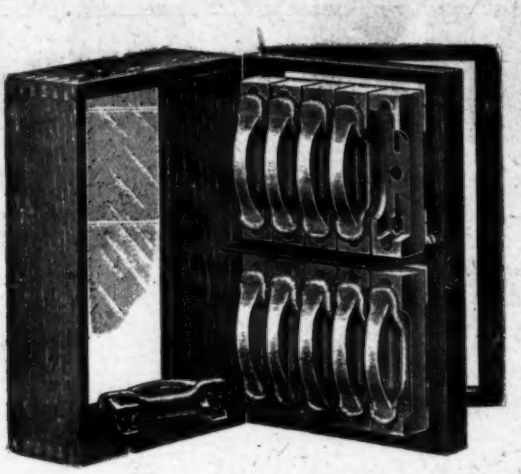


BROWN-BOVERI TIME LIMIT OVERLOAD RELAYS, TYPE H.

Time of Trip is Independent of Load current. No Series Transformer Required. Over 2,000 in use.

9, Old Queen Street, Westminster, S.W. 1.



Tucker "H.O." Pattern Fuse Boards . . . . single- double- or triple-pole. In Teak or Iron Cases . . .

We make several different patterns of Fuseboards. The "H.O." range illustrated comply with the Regulations of the Home Office. Accidental contact with live metal is impossible. The Board illustrated is mounted in a teak case fitted with a "swing back" attachment, which facilitates erection of the Boards and allows of easy and immediate access to the connections at any future time . . . . . We make "H.O." pattern Boards for

All Standard Capacities.
Voltages up to 500 Volts.

J. H. TUCKER & Co.,
KING'S ROAD, ... HAY MILLS,
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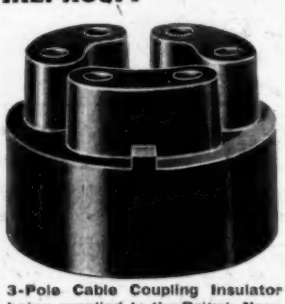
PROMPT DELIVERY. **SILUMINITE.** PROMPT DELIVERY.

The New British Insulating Material, as used by the Government and leading Electrical Firms and Railways.

FIREPROOF. ***NON-HYGROSCOPIC.*** ***HIGH ELECTRICAL RESISTANCE.***



3-Pole Cable Coupling Insulator being supplied to the British Navy.

WITHSTANDS HEAT, ATMOSPHERE, HOT TRANSFORMER OIL, ALKALIES, OZONE, WATER, &c.

Rich black colour, and readily polishes.

HIGH ELECTRICAL RESISTANCE,
13,000 Volts per Millimetre.

Does not soften under any heat.

Moulded readily during manufacture into any shape. Moulded on iron pins and into caps, etc. Can be applied to metal parts.

LOW IN PRICE.

DOES NOT SOFTEN OR WARP.

SHEET
FROM
6d. PER LB.

Replaces Glass, China, Slate, Marble, Fibre, &c
TURNS, TAPS AND DRILLS.

THE SILUMINITE INSULATOR CO., LTD.,
Telephone: SOUTHALL, 59. **The Green, Southall, Middlesex.** *Telegrams: "SOUTHALL, 59."*

Printed by WILLIAM CATE, LTD., 147-150, Saffron Hill, E.C. 1, and Published by the Proprietors, H. ALABASTER, GATEHOUSE & KEMPE, 4, Ludgate Hill, London, E.C. 4.

Union of Railwaymen, the secretary of which informed the Strike Committee that he was not prepared to negotiate for a settlement until work was resumed. On Monday the Strike Committee recommended a return to work whilst the negotiations were taking place. This was agreed to, and a resolution that a holiday should be taken on Tuesday and work resumed on Wednesday was carried unanimously. Meanwhile all the lines were kept open and a restricted service was run. A number of stations were closed, and the others greatly congested.

Mr. Wyatt, of the Electrical Trades Union, is reported to have said that he had no fear that the trouble would involve the employés at the generating stations, although the Union supported the principle of equal pay for equal work.

Middlesbrough. — Proposed Purchase. — A special meeting of the T.C. is to be held to consider the question of exercising its right to purchase the portion of the Middlesbrough, Stockton, and Thornaby tramway undertaking belonging to the Imperial Tramways Co., which is within the Borough of Middlesbrough. Application for purchasing powers has been made to the B. of T., and the company has been informed by the Council of its intention.

Oldham.—Year's Working.—The annual report of the Corporation tramway department shows a total revenue of £151,411, against £127,284 in the previous year; working expenses and war allowances increased from £85,443 to £106,937. The car-mileage was 2,121,092, against 2,010,604, and passengers carried numbered 28,703,000, an increase of four millions. The number of units used was 3,653,455, against 3,349,666. The average traffic revenue per car-mile was 16·8d., and the working expenses, including power, were 12·1d.

Omnibuses on Tramway Routes.—Replying to a question by Mr. Gilbert in the House of Commons, Sir A. Stanley, President of the B. of T., stated that omnibus companies had been requested not to increase their services on tramway routes where, to secure reduction in the consumption of fuel, tramway services had been reduced.

Rawtenstall.—Year's Working.—For the year ending March 31st, the income of the T.C. tramway department amounted to £35,261, or 14·69d. per car-mile, compared with £30,169 in the previous year. Working expenses amounted to £21,279, or 8·86d. per car-mile, against £17,952. Energy cost £4,924, or 2·05d. per car-mile. Capital charges absorbed £12,694, or 5·41d. per car-mile, against £12,490, and included interest on loans, £5,869; sinking fund, £5,732; and interest on accumulated fund, £1,362. The net profit was £1,187, which, with £3,000 transferred to the accounts from the borough rates, was placed to the renewals fund. Since the undertaking was commenced in 1908 it has received financial aid from the borough funds to the extent of £16,954. Passengers carried numbered 6,062,849, and 576,175 car-miles were run; 874,071 units were used during the year, or 1·52 per car-mile.

Rio Janeiro.—Electric Omnibuses.—The Brazilian Traction, Light, and Power Co. has obtained from the Commercial Truck Co., of Philadelphia, some electric accumulator omnibuses to be used on routes not served by its tramways. The omnibuses are of the single-deck type, and have a seating capacity of 32 passengers. The vehicles are equipped with an Edison battery of 72 cells, with a rated capacity of 350 ampere-hours. Motors are placed on each of the four wheels, the drive being through concentric gearing with a ratio of 12·14 to 1. With a full load on good level roads the vehicle can run 35 miles on a single charge, and with half load, 40 miles. Each vehicle can make 12 round trips of 2·26 miles during the day, giving a total daily mileage of of 27·12, the running time being four hours, or 20 minutes per trip, with a total of 24 stops. During the tests the power consumption worked out at 294 ampere-hours, the initial voltage of 89 dropping to 73 at the completion; the running time was 3 hours 59 minutes. At the start the battery temperature was 100° F., and at the finish 105° F., the air temperature being steady at 58° F.

Sunderland.—Fare Increase.—The T.C. has increased the existing 1d. tramway fares to 1½d., and also proposes to reduce the services.

West Ham.—Strike.—The workers who were on strike have returned to work, the Corporation having granted the increase of 5s. to those workmen who did not receive a recent advance in wages.

TELEGRAPH AND TELEPHONE NOTES.

Australia.—Owing to the scarcity of materials, new telephone and telegraph services and transfers have been restricted to cases in which the material already installed can be utilised.

Broken Insulators.—During the hearing of a summons against a young boy at Preston for having attempted to damage the insulators on a telegraph pole by means of a catapult, it was stated that it cost £577 to replace broken insulators in that area in 1916, but, thanks to the assistance of the police, the number was reduced from 3,300 to 1,500 last year, at a cost of £262, and for eight months this year the number was 750, costing £131. Even these figures were serious, in view of the difficulty of finding labour and materials.

Canada.—Ninety-nine per cent. of the telegraph operators throughout Canada have voted in favour of the acceptance of the minority award of the Board of Conciliation, and have threatened to strike if that award is not adopted.—*The Times.*

Holland.—The Amsterdam *Telegraaf* states that the new long-distance wireless station is to be situated at Hoogburlo, near Apeldoorn; the Indian station will be erected near Banddeng, Java. The distance between the two is 11,000 km.

CONTRACTS OPEN AND CLOSED.

OPEN.

Atherton.—September 16th. U.D.C. Two 110-kw. single-phase transformers. See "Official Notices" to-day.

Johannesburg. — September 16th. S. African Railways and Harbours Administration. Supply, during 1919, of electrical cables and wires and bare copper wire (tender No. 163). A copy of the specification, &c., may be consulted by British manufacturers at the Inquiry Office of the Department of Overseas Trade (Development and Intelligence).

Manchester.—September 13th. Corporation Electricity Committee. 3½-ton electric tipping wagon. See "Official Notices" August 23rd.

Spain.—The municipal authorities of Lillie (Province of Toledo) have recently invited tenders for the concession for the electric lighting of the town during a period of 19 years.

NOTES.

Boys' Escapade.—Before Bailie Sinclair, at a Juvenile Court in Aberdeen, five Woodside boys pleaded guilty to a charge of having entered the tramway depôt at Woodside and seized an electric car, with the intention of driving it off. It was stated that the boys not only took possession of the car, but started it, driving through the doors, and they were proceeding on their way when the trolley became detached, bringing the adventurous crew to a halt. The car was then recaptured. One of the culprits was put on probation, and the others were dismissed with a warning.

Mica in Australia.—Supplies of imported mica in Australia are almost exhausted, and efforts are being made to develop the Australian deposits. Unfortunately, they are a long way from the coast, and labour is scarce. The Government of Western Australia is offering a bounty for mica, and operations have been commenced. It is urged that either a tariff of 25 per cent. on imported mica or a bounty on Australian mica, plus a lower duty on imports is necessary to maintain the industry after the war.

Engineers' Wage Bonus.—In accordance with the national agreement in the engineering and foundry trades, the Committee on Production issued one of its periodical awards on July 24th, imposing on firms which are members of the Engineering Employers' Federation an advance of 3s. 6d. per week to men over 18 and 1s. 9d. per week to boys and apprentices under 18, from the week ending August 10th. As provided by the Munitions of War Act, 1917, the Ministry of Munitions is now issuing an Order which applies the provisions of the award to a large number of non-federated firms in the engineering and foundry trades.

Whitley Councils.—Speaking at Norwich last Saturday, Mr. G. H. Roberts, Minister of Labour, said complaint was made that progress in establishing these Councils was slow; but it was a difficult task. Many parties had to be considered, and some time must elapse before a Council was provided in every trade. Nine Councils were now in existence, 19 more were in various stages of formation, and 20 preliminary conferences had been held. The movement was receiving a good deal of support from both employers and organised workmen. If we could establish a proper spirit between the two sides we should make profound changes in the structure of society and in the development of industrial processes. Efficiency could be promoted and productivity stimulated without casting any additional burden on the workers as a whole.

Electric Pumping Machinery.—A large dry dock is nearing completion at Hunters' Point, South San Francisco, which is 1,050 ft. long. The dock will be able to accommodate any vessel afloat, and is described as the largest in the world. Powerful electrical pumping machinery has been provided by the Westinghouse and General Electric Companies, and in every respect the equipment is believed to be of the most modern and efficient type.

Fatality.—An electrical engineer, Cecil Walton Eddowes, of Bradford, was knocked down by a goods train at Hirst Lane Bridge, near Saltaire. He was on the staff of the Bradford Corporation as a switchboard attendant. A verdict of "Suicide" was returned.

Fuel Economy.—Referring to the article by Mr. W. H. Booth on fuel economy which appeared in our issue of the 9th inst., Capt. W. P. Durtnall writes that if this country is to compete successfully with other countries it must scrap steam power and immediately get to work on the proper installation of gas-power generated electrical energy, as this will allow supply to be given at least at half the price that any steam plant can possibly do it at.

Sending us a drawing of the "Paragon" gas motor, which was designed to form the prime-movers of a great scheme for supplying London with cheap power in 1915, he states that the features of improvement are (1) reduced surface exposed to the burning fuel, and (2) greater expansion of the gases, resulting in a brake thermal efficiency of at least 40 per cent., with a silent exhaust at a temperature of only 300° to 400° F.

The generating set shown is made up of two 2,000-B.H.P. units, direct-coupled to a special induction-type alternator; the 16 cylinders are of the double-acting type, fitted with piston valves, and give a uniform turning moment; the expansion is taken down almost to atmospheric pressure, providing a very silent exhaust, whilst the compression pressure is only 300 lb. per sq. in.

The engine is designed for operating on gas at 400 lb. pressure and with a calorific value of 1,000 B.TH.U. at atmospheric pressure; the jacket-heat loss is transmitted at boiling temperature and exposed to the atmosphere by means of small water or air-cooled steam condensers, the water being returned by gravity to the engine.

No ignition apparatus is required, as sufficient heat is contained in the compression and incoming gas to secure rapid and efficient combustion.

Standardisation of Aircraft Materials and Parts.—The standardisation of aircraft materials possesses two aspects—namely, the national effort at drawing up specifications for aircraft materials and parts for *immediate* use, and the more difficult problem of attempting to arrive at truly international specifications. With regard to the specifications in use in this country, the work commenced in the first instance by the Technical Department of the Air Board has resulted in the well-known Air Board Specifications, a very large number of which are in use throughout the aircraft industry. Towards the end of 1917, however, at the request of the British aircraft constructors, the British Engineering Standards Association appointed a representative Sectional Committee to take up the standardisation of aircraft materials, and at the beginning of the current year the Air Ministry, subsequently to the reorganisation of the Department of Aircraft Production, reviewed the whole situation regarding the procedure adopted for the drafting of specifications, and decided to place entirely in the hands of the British Engineering Standards Association, as a war measure, the standardisation of aircraft materials for the Services. Since January, 1918, therefore, the work has been under the auspices of that Association.

The Sectional Committee, which is now under the chairmanship of Sir Arthur Duckham, K.C.B., Director-General of Aircraft Production, governs the whole of this work, and has some 60 Sub-Committees and Panels under its jurisdiction engaged in drafting specifications, including the revision of many of the old Air Board specifications. This work is being carried out as a war measure for the Department, and consequently these specifications are not issued to the general public, but to the Department itself for distribution to manufacturers.

The subjects being dealt with cover practically the whole field of materials employed in aircraft production (some 40 British standard specifications).

With reference to the more difficult question of arriving at international agreement regarding aircraft specifications generally, at the request of the Ministry of Munitions the British Engineering Standards Association has nominated the British Section of the International Aircraft Standards Commission, brought into being at the Inter-Allied Aircraft Conference held in London in March last. The British National Committee is under the chairmanship of Sir Arthur Duckham, K.C.B., and is fully representative of all interests concerned.

National Committees are being formed in America, Canada, France, and Italy. The Inter-Allied Conference held in March is to be considered as the first meeting of the Commission; the second meeting is scheduled for the beginning of October next, and will be held in London.

At first sight it may be asked: What has the electrical industry to do with aircraft? The reply is found in the fact that out of the 41 specifications which have already been issued by the Department of Aircraft Production, no fewer than 15 deal with electrical materials or appliances—such as low-tension flexible cables, electric supply potential and system of distribution, high-tension cables and connectors, plugs and sockets for electrically heated clothing, wireless apparatus, accumulators, and incandescent lamps for navigation and recognition lights.

It will be seen, therefore, that the electrical industry is materially interested in aircraft manufacture, and we understand that the Sub-Committee on "Electrical Parts" (chairman, Mr. C. C. Paterson, O.B.E.) is so busy that, in view of the rapid extension of the use of electrical appliances on aircraft, demands for specifications have made it necessary for seven Panels to be at work.

There is a special Sub-Committee on sparking plugs (chairman, Brigadier-General Sir Capel Holden, K.C.B.), by which recommendations as to the leading external dimensions of sparking plugs for stationary and rotary aircraft engines have been made.

Another Sub-Committee on Magnetos (chairman: Lieut.-Commander E. S. Saunders, R.N.V.R.) has drawn up standard dimensions and limits for the various types of magnetos used for aircraft work. This report is practically completed.

At the request of the Ministry of Munitions, the Main Standards Committee has nominated the Sectional Committee as the British National Committee of the recently formed International Aircraft Standards Commission. The French National Committee has been also formed, and the American, Canadian, and Italian are in process of formation. Specifications are being exchanged officially, and it is hoped that much good will accrue through this organised interchange of ideas.

The International Aircraft Standards Commission will issue as agreement is reached International Specifications for Aircraft Materials.

Institution and Lecture Notes.—Electrical Power Engineers' Association.—On Thursday, the 22nd inst., a general meeting of the Glasgow Branch (Northern Division) was held at Glasgow. The progress of the Branch was reported to members both as regards work done by the Committee and acceptance of new members. There was a good attendance, and Mr. Clayton, of Manchester, addressed the meeting.

Junior Institution of Engineers.—A paper on "Static Transformers," read by Mr. S. A. Stigant before the North-Eastern Section on June 11th, is printed in the August issue of the *Journal*.

Appointments Vacant.—Women tracers for the Admiralty Department of Electrical Engineering; shift engineer (£156 to £175) for the Kilmarnock Burgh Electric Lighting and Tramways Department; switchboard attendant (43s. 6d. + 12½ per cent.) for the Leith Corporation Electricity Department; charge engineer (67s. 6d.) for the Bedford Corporation Electricity Works; visiting lecturer and demonstrator in electrical engineering for the Wolverhampton Corporation Education Committee. See our advertisement pages to-day.

Employment of Disabled Sailors and Soldiers.—Two useful publications have just been issued by the Ministry of Labour dealing with openings in industry suitable for disabled men. They have been prepared by the Trade Advisory Committee (Shipbuilding and Engineering Trades). No. XV, "Engineering. Part I," deals with schemes for training men in certain light machine operations and trades; the processes suitable for partially-disabled men are analysed, and the instructions issued by the Ministry of Pensions to regulate the training are appended, together with particulars as to the maintenance allowances during training, technical school fees, &c. Applications from men or employers should be addressed to the nearest Local War Pensions Committee. No. XVII, "Engineering, Part II," deals with electrical engineering, in four sections:—Dynamo and Motor Manufacture, Cable Manufacture, Switch and Control Gear Manufacture, and Instrument Manufacture. An exhaustive list of minor operations and skilled trades is given, followed by a detailed statement of the degrees of disablement which would not debar employment in each case. The prospects of continuity of employment are stated to be good, and full particulars of the approved training courses are given.

These reports will be of the utmost value both to disabled fighting men and to employers; they can be obtained from H.M. Stationery Office or any bookseller, price 1d. each.

Multifilament Incandescent Lamp.—A new incandescent lamp has been designed by T. B. Rider, of Los Angeles, the filaments of which are so arranged that in case one of them breaks or burns out another filament of the same candle-power is connected into circuit. The lamp has 12 filaments of 25 C.P. each, of which four are lighted at a time when the lamp is turned on, and the next four come into action in sections of 25 C.P. as each of the four originals is lost. Thus the lamp always gives 100 C.P. until the last substitute is used. When this is the case there are still the auxiliary filaments left, so that the life of the lamp is three times that of an ordinary lamp, or still greater than this if it is operated at reduced candle-power, when most of the filaments have failed. A filament when in action is held taut by a spring at its base, and the failure of the filament allows the spring freedom to move far enough to touch a contact in connection with the next substitute filament, and so on.—*Electrical Review and Western Electrician*, May 25th.

Effect on the Eye of Different Illuminants.—Experiments to test the effect on the eye of different illuminants are described in the *Transactions* of the American Illuminating Engineering Society by Messrs. C. E. Ferree and G. Rand. They include various electric incandescent lamps—carbon, tungsten, tungsten with blue bulb—and a kerosene lamp. Results are plotted in terms of "time clear to time blurred" to indicate the degree of fatigue as in previous work. The results suggest that the colour is an element of some consequence. The loss of efficiency of the eye, on the above criterion, was least with a tungsten lamp giving a "white" light, greater with a carbon lamp and a kerosene lamp, and highest with the lamp with a blue bulb. It thus appears that the least fatigue was sustained with the light approaching nearest to white.

Inquiries.—Correspondents ask for the names of makers of the "Lowa" dimming switch, of an electrical baling press, and of electric switch dials.

Volunteer Notes.—London Army Troops Companies, Volunteer Engineers.—Headquarters: Balderton Street, Grosvenor Square, W. 1.

Corps Orders No. 36, by Lieut.-Colonel C. B. Clay, V.D., Commanding:—
Captain of the Week.—Capt. W. Darley Bentley.
Next for Duty.—Capt. R. G. Fleming.
Sunday, September 1st.—Commandant's Parade, Waterloo Station, 8.45 a.m., opposite No. 9 Platform, for work at Esher. Dress: Drill Order, without rifles. Mid-day and tea rations to be carried.
Monday, September 2nd, to Friday, September 6th.—Drills as usual.

C. Higgins, *Capt.* R.E., *Adjutant.*

Electrical Methods of Killing Sharks.—It is reported that the fishing fleets in the Northern Atlantic Ocean have instituted a new method of killing sharks that have lately caused considerable trouble on the fishing grounds. It appears that the bait hook is connected by an insulated cable to one pole of an electric generator, the other pole of which is connected to the hull of the ship. When the drum on which the cable is wound is revolved by a pull by the shark, the cable is touched by a rubbing contact which connects it to the source of supply and kills the shark electrically.

Electrician Rewarded.—Mrs. Kean, Kilmarnock, has received a cheque for £50 from the Admiralty as an award to her husband, Adam A. Kean, motor mechanic, for his "coolness and promptness in the handling of his engine" during an attack by an enemy submarine in the East. Prior to enlisting Mr. Kean was employed as chief electrician and motor mechanic with the Dunlop Motor Co., Ltd., and at present he is acting as chief motor mechanic on a submarine chaser.

Improvements in Telephone Cables.—French Patent No. 482,722 of the French Thomson-Houston Co. describes a telephone cable in which the insulating material is coated with a very thin layer of metal that is deposited by electrolysis or by a hot metallic spray. The layer of metal carries away disturbing currents and also affords an effective protection against the oxidisation of the insulating material.—*Revue Générale de l'Electricité*, May 25th.

Electrical Training of Discharged Soldiers.—The third half-yearly report of the Middlesex War Pensions Committee states that 103 discharged soldiers have been given trade instruction during the past six months. Of this number 10 were trained as electric sub-station attendants; 1 chose kinematography, 14 electrical engineering, and 4 electrical testing.

The Prince Albert City Default.—The *Financial Times*, referring to the default on the July coupons of the Prince Albert City debentures, says that Prince Albert City "spent over £200,000 on a hydro-electric plant that had to be abandoned, and the population, which was 11,000 when the bonds were issued in 1913, fell to 8,500 in 1916."

Vladivostok Tramways.—Reuter's agent at Vladivostok states that it is reported that by a private deal between the Americans and the municipality, 3,500,000 roubles (£350,000) have been lent to the town on the security of the tramways.

Electric Steel in Australia.—The Victorian Iron Rolling Co., Melbourne, will shortly install a 6-ton electric steel furnace of the Héroult type. The transformers and a supply of electrodes have been ordered in America. Energy will be taken from the Melbourne City Council's station.—*Commonwealth Engineer.*

The Australian Electric Steel Co. is opening a branch smelting works at Midland Junction, Western Australia, for the purpose of converting the large quantities of available scrap into steel ingots for local use and for export. For some time past the company has been supplying the Government tramways with electric steel for axles and wheel centres. The furnace that is being installed is one of the largest yet attempted by the company. The whole of the power will be derived from the Government power house at East Perth, some 10 miles from the works; about 1,000 kw. will be required.—*Australian Mining Standard.*

Educational.—Manchester Municipal College of Technology.—In February last we announced the decision of the Governing Body of the College to set up a Lectureship in Industrial Administration; the City Council is now inviting applications for the appointment, at a salary of £600 a year for five years. It is also proposed to institute a series of afternoon or evening lectures on the subject during the coming winter session. Particulars will be found in our advertising pages to-day.

Waste Heat.—According to the *Daily Telegraph*, in a recent lecture at Charlottenburg, the economical use of coal for domestic purposes was discussed, and an example of the utilisation of the waste heat from a generating station was given, in which complete heating arrangements had been carried out in 300 workmen's dwellings by the waste heat of a neighbouring power station, the annual saving of fuel being estimated at 3,000 tons. Obviously much depends upon the effective transmission of hot water through a system of well-lagged pipes. If this can be accomplished, then the delivery of water at a moderate temperature of, say, 120° F. should suffice for most domestic purposes. It is hot enough for cleansing purposes, and, where necessary, can be raised to boiling point with a limited supply of heat. In carrying out such a system it is claimed that water can be transmitted in a 12-in. main suitably lagged at a temperature of 100° F. above ordinary temperature at the rate of 3 linear ft. per second, with a loss of 1·65 to 3·3 per cent. of heat per mile, giving a total loss of 6·6 to 13·2 per cent. over a 4-mile radius.

Private Arrangements.—Landaulet Co., Ltd., Upper Manor Street, Chelsea.—Pursuant to Section 188 of the Companies (Consolidation) Act, 1908, a meeting of the creditors of the above-named company was held on August 26th at 20, John Street, Adelphi, W.C. 2, having been called by the liquidator, Mr. R. G. Sidford. It was stated that a petition had been filed by the largest creditors, Messrs. Bowley & Son, whose debt was about £400, for the compulsory winding-up of the company, but this firm, who were represented, intimated that the reason of this was because they wished an independent liquidator to be appointed. In that event they were prepared to withdraw the petition, but otherwise they would ask the Court to make a winding-up order. After discussion it was, therefore, resolved that application should be made to the Court to appoint the nominee of the petitioning creditors, Mr. W. Viney, C.A., as liquidator in the place of the existing liquidator, and it was understood that the petitioning creditors would apply to the Court for an order to this effect. It appeared that the company was registered on February 24th, 1902, with a nominal capital of £50,000, divided into 5,000 shares of £10 each. The total number of shares issued subject to payment wholly in cash was 3,928. The name of the company in the first place was the Electric Landaulette Co., Ltd., but this style was changed to the Landaulet Co., Ltd., on January 3rd, 1911, the registered offices of the company being Upper Manor Street, King's Road, Chelsea. The business of the company consisted mainly of letting out motor-cars on hire, and in May, 1917, when the Government made an Order restricting the use of petrol and also the letting out of motor vehicles except for certain purposes, the business was practically brought to a standstill, and the debenture holders, who then wanted £4,000, appointed Mr. Sidford to act as receiver. The receiver has paid off the debentures with the exception of a small sum.

Amalgamation of Technical Workers in Germany.—According to the *Vorwärts*, the directors of the Association of Technical Minor Officials and Employés (the B.t.A.) recently recommended their members to accept the proposals for amalgamation which were the upshot of the negotiations with the Association of Technical-Industrial Employés (the B.t.i.B.), and instituted a ballot to ascertain the wishes of the members. Some 80 per cent. of them voted, and the proposal was accepted with only one dissentient. The result shows how the large majority of the members were in favour of amalgamation. Since the amalgamation is to be carried out in such a way that there will be no change in the position or management of the B.t.i.B., it was not necessary to take the votes of the members of the latter association on the matter. It is clear, however, that the amalgamation of the two associations means more than the avoidance of a regrettable split in organisation. It is to be hoped, says the *Vorwärts*, that it is the precursor of an era of prosperity and agreement. Such amalgamation does not presume that divergencies of opinion must be suppressed, but disputes on facts must be settled as such, and must not entail personal quarrels.

Standardisation of Voltages.—With regard to the proposed standardisation of voltages, both for lighting and power circuits, we are informed that the Tungsten Lamp Association has formally endorsed the standards advocated by the B.E.A.M.A. and the British Engineering Standards Association, *i.e.*, 100, 110, and 115 volts (for low voltage), and 200, 220, and 230 volts (for high voltage). The association, however, does not propose an immediate alteration to these limits, but for the present intends to adopt the following as the standard voltage range:—

Under 100 volts: 25, 50, and 55 volts.
Low voltage: 100, 105, 110, 115, 120, and 125 volts.
High voltage: 200, 210, 220, 230, 240, and 250 volts.

Lamps of these voltages will be supplied at standard prices, but an extra charge will be made for all lamps of intermediate and higher or lower voltages. These voltages are adopted as a start towards the standardising movement recommended by other prominent associations, and comprise a much larger number of voltages than it is intended ultimately to adopt.

Such standardisation would secure tremendous advantages for the electrical manufacturer, while factors, contractors, and dealers, and even consumers, would benefit. At the present time the variety of voltages in actual use constitutes a serious disadvantage, seeing that the manufacturer is committed to the multiplicity of types, and the trade is compelled to carry an unnecessary variety of stocks of similar material. Further, it very seriously interferes with the continuity of manufacture, delays production, and inevitably increases the cost of manufacture.

In Continental practice the number of voltages in regular demand is limited to one or two in both high and low voltage ranges, while in the U.S.A. and Canada an effective movement has been made during the past four or five years to reduce the number of standard voltages to not more than three, such as the present policy of the T.L.A. aims to secure. Manufacturers of all classes of electrical material realise the necessity for a similar standardisation in this country, and the Tungsten Lamp Association considers it desirable to associate itself with the movement. The lamp manufacturers hope that this very necessary restriction will be generally supported by all electrical interests both on the power and lighting sides of electrical work.

An Electrically-operated Shipyard.—Lord Pirrie, who is on a tour of inspection through the shipbuilding areas of the North-East Coast, visited the Egis Yard on Monday, August 26th. This yard, on which work was begun in November, is now nearly completed. It covers a site of nearly 16 acres on the banks of a North-East Coast river, and is entirely driven by electricity. It has four berths, each capable of building a ship 430 ft. long by 56 ft. beam, and of about 10,000 tons deadweight. The principal buildings are erected on each side of the berths. On the south is a platers' shed, 532 ft. long by 100 ft. broad, which contains all the most up-to-date electrically-driven machinery for working the steel material. Direct gas-firing furnaces for frame and plates are installed. The means of erecting the material when worked on to the slips is provided by 20 steel derrick posts 98 ft. long with 35-ft. derricks, four on each side of each ship, with an independent electric winch capable of lifting 3 tons to each derrick. Six other portable electric winches are also provided for use where required.

On the east side of the yard are the general stores, joiners' shop, mould loft, mast shed, with machines for making all masts, derricks, ventilators, &c., and a carpenters' shed. On the north-east side is a fitting-out quay 466 ft. long, where the vessels will be fitted out after launching. Along the quay is a 30-ton electrically-driven travelling crane capable of lifting 30 tons at a radius of 54 ft. and 10 tons at a radius of 90 ft., the height above crane wheels being 98 ft. On the west side are the beam shed, smiths' shops, finishing shops, plumbers' shops, &c., all equipped with the latest and most efficient machinery. Electric power and lighting, pneumatic piping, water pipes, &c., are taken down between each berth, and every facility is provided for utilising pneumatic power to the greatest possible extent. The shipyard is driven throughout by electricity supplied on the three-phase system. (See also Elec. Rev., August 16th, 1918, p. 164.)

The Growth of Electrical Refrigeration.—One of the most remarkable new applications of electrical energy is that of refrigeration and cold storage. This growth is well emphasised in developments in Southern California. Converts to the electrical method were slow at first, but the increase now seems to be in the geometric ratio. In fact, since September, 1917, the commercial department of the Southern California Edison Co. reports that several plants have been induced to electrify, amounting in all to about 4,000 h.p., one alone being over 2,000 h.p. This class of energy is better than an annual load factor of 80 per cent. and a power factor close to unity, on account of synchronous motors, is most ideal. The use of refrigeration as a whole is on the increase. The building of a series of cold storage plants at shipping ports is part of the present national food conservation plan and a campaign is being conducted in this connection to break down public prejudice. On the other hand, the domestic possibilities in electrical refrigeration have not begun to be realised—and the development of an inexpensive household equipment is one of the most fascinating problems remaining to the experimenter. The United States probably uses ice in the household to a greater extent than any other country. In Europe, for instance, the domestic ice box is almost unheard of, there are no "consumer's" ice companies and the general practice is to boil the milk and to do without such meats as will not keep in the summer. In America however, the demand is already created, and it remains only to turn it into electrical channels—a feat which is fast being accomplished in the commercial line, as pointed out in the two articles on refrigeration appearing in the August 1st issue of the *Journal of Electricity*.

Temperature Measuring Apparatus. — According to *Elektrotechnic und Maschinebau*, special apparatus has recently been contrived to measure rapidly fluctuating temperatures such as an ordinary thermometer is too sluggish to record. At the point of measurement, wires of platino-iridium, 0.02 mm. diameter, are inserted and are connected to a galvanometer. The deflection varies with the resistance of the wires, and it is stated that variations in temperature with a frequency of ten per second may be noted. It is anticipated that the apparatus will be specially useful for studying cyclical variations in temperature in the cylinders of steam engines and combustion engines.

Fuel Economy in the U.S.—State Administrative Engineers of the United States Fuel Administration held a Conference in Washington, on June 28th and 29th, discussing the plan of organisation in connection with the conservation of fuel in power plants throughout the United States. An Administrative Engineer will be appointed for each of the States in the area mentioned. The object is to operate all industries at full capacity, but to make every lb. of fuel perform maximum service.

The National plan comprises certain fundamentals, as follows:—(1) Personal inspection of every power plant in the country. (2) Classification and rating of every power plant, based upon the thoroughness with which the owner of said plant conforms to recommendations. (3) Responsibility of rating the plants will fall upon the Administrative Engineer in each State; the rating to be based upon the reports of inspectors, who will not express opinions, but will collect definite information. The State Fuel Administrator, in his judgment, may entirely or partially shut off the supply of coal to any needlessly wasteful plant in his territory. (4) Inspectors are to be furnished from one or more of the following sources: inspectors of the steam-boiler insurance companies; State factory inspectors; engineering students from technical colleges; volunteers and others.

The ratings will be based upon recorded answers to questions, each of which will be given a value depending upon its relative importance to the other questions. Depending upon the efficiency of methods in use in any plant, it may be rated in Class 1, 2, 3, or 4.

The Administrative Engineer in each State will have supervision of electrical and mechanical problems connected with fuel conservation activities contemplated under this plan. The ratings will be based upon existing equipment. The difficulty, delay, and expense involved in the installation at this time of improved power equipment is fully recognised; but experience has proved that 10 to 20 per cent. of the fuel now used in power plants can be saved by improvements in operation alone. It is recommended that a Board of competent engineers be attached to the Conservation Committee in each State; also a corps of lecturers to arouse public interest and disseminate engineering information. The Fuel Administration has prepared a 50-minute film of moving pictures showing good and bad operation in the steam-boiler plant, methods of testing boilers, &c. These pictures will be available to each State in connection with educational propaganda. The Administration is also preparing a series of official bulletins on engineering phases of steam and fuel economics. As the work develops, still further constructive assistance is contemplated for helping owners to bring their plants up to a high plane of economic operation.—*Electric Traction.*

Electroculture.—To those who take an interest in electroculture the accompanying illustration of a few of many similar potatoes recently lifted at Chester will be of interest. The potatoes are of the "Great Scot" variety, and the photograph with the

Potatoes grown under Electric Discharge.

2 ft. rule gives an idea of the size of the tubers. The individual potatoes weigh from 1 lb. 1¼ oz. to 1lb. 4 oz. Mr. S. E. Britton, city electrical engineer, who sends us the photo., is not yet in a position to give comparative results, which, however, we shall await with interest.

Electrically-driven Rolling Mills.—At the annual meeting, last week, of the Sheffield Forge and Rolling Mills Co., Mr. C. E. Siddall, who presided, said that the new electric mills, which the company had been putting down for the past two years, were not yet running, owing to the delay in obtaining the necessary permits, but he hoped that the first mill would be running within a week. The adoption of electric drive had been severely criticised, chiefly by people who knew nothing about it, but who were the first to copy it immediately it was got going; in adopting electric drive, the right thing was being done. There was no better illustration of that than the fact that that morning the electric sheet mill was running in spite of the coal strike. If the two electric mills could have been running, it would not have mattered about the rest of the works—everybody would have been satisfied. The electric drive had been given a fair trial, and it had proved successful. The sheet mills had paid for themselves during the three years they had been running. The running cost was less than steam, and it was intended gradually to electrify the whole of the works; this would not mean any diminution of dividends, but rather the opposite.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Greenock Corporation has increased the salary of the borough electrical engineer, Mr. F. H. Whysall, by £100 per annum.

Mr. H. P. Stokes, general manager and electrical engineer to the Bexley Council Electricity and Tramways Department

and Dartford Light Railways, has been appointed district engineer in connection with the coal economy campaign.

According to the *Commonwealth Engineer*, Mr. J. C. Lane, superintendent of the Melbourne City Council electric power station, was severely burned by an explosion of gas which occurred in one of the boiler furnaces in May during an investigational run with brown coal.

General.—The marriage took place at Edinburgh, on August 24th, of Mr. J. H. Bunting (general manager of Bruce Peebles & Co., Ltd.) and Janet (Nettie) Rintoul, eldest daughter of Mr. and Mrs. Henry Mitchell, Edinburgh.

Mr. P. A. Spalding, engineer and manager of the Dundalk electricity undertaking, has been appointed by the Controller of Coal Mines a district engineer to assist in the coal economy campaign.

A commission in the Indian Army has been granted to Mr. C. H. Branson, who was prior to the war an electrician with Messrs. Joslins, Ltd., of Colchester. He has served in India with the East Surrey Regt. since early in the war.

A farewell luncheon in honour of Mr. R. W. Dalton, H.M. Trade Commissioner for New Zealand, was given at Wellington, N.Z., last week. The luncheon was given by representatives of British manufacturers.

Mr. R. N. Tweedy has received a commission (technical) in the R.A.F., A.O.S. branch. He will be stationed at headquarters in Dublin, 65, Fitzwilliam Square, in charge, under the C.O., of the power and lighting installations at all the aerodromes in Ireland. In consequence, he has resigned the appointment as manager of the Dublin and South of Ireland branch of Messrs. Wm. Coates & Son, Ltd., which he has held for nearly 12 years.

Roll of Honour.—Corporal J. Regan, Manchester Regiment, posted missing in October last, and now reported killed, was employed by Messrs. Ferranti, Ltd., Hollinwood.

Private J. H. Bailey, Dragoon Guards, killed in action, was with Messrs. Royce, Ltd., Trafford Park.

Private A. Samyn, 6th Belgian Chasseurs, who was in the electrical department of Messrs. Vickers, Ltd., of Sheffield, has been awarded the Belgian Military Medal for saving the life of his colonel; he has also received the French Military Medal, and the Belgian War Cross.

Private Gale, who has died in Egypt from malarial fever, was manager of the electric light station at Topsham (Devon).

Sergeant T. Standing, R.W. Kent Regiment, who was for 17 years with Messrs. G. Weeks & Sons, electricians, Bromley (Kent), has fallen in action.

Major B. S. Benning, R.A.F., of Dunstable, who has been awarded the Croix de Guerre with the palm leaf, was formerly engaged in wireless work with the Marconi Co.

Lieutenant H. B. Wilson, R.A.F., who has been accidentally killed whilst flying in Wiltshire, enlisted whilst engaged at Aden with the Eastern Telegraph Co.

Private F. B. Woffenden, Durham Light Infantry, and prior to last September employed by Messrs. Sykes & Sugden, electrical engineers, Huddersfield, has died of wounds received in action.

Private L. T. Seed, West Riding Regiment, who was an electrical engineer at Halifax, was killed in action on July 28th.

Corporal A. Shutt, Royal Fusiliers, Lewis Gun Section, who has been killed in action, aged 20, was with Messrs. Bottomley & Frampton, electrical engineers, Blackpool. He was the only son of Mr. Edgar Shutt, of the Blackpool Corporation Electricity Works.

Private A. H. Bowery, who was formerly employed in the glass-blowing department of the Westinghouse Cooper-Hewitt Co., Ltd., has been awarded the Military Medal for gallant conduct in the field.

Pioneer A. Gregory, R.E., who is a prisoner of war at Giesson, Germany, was an employé of the St. Helens Cable and Rubber Co., Ltd.

M. C. Espir, son of M. Lucien Espir, managing director of the General Electric de France, Ltd., has been awarded the Croix de Guerre for energy and bravery, in ensuring the *liaison* under violent bombardment in July between an American battalion and the French troops close by.

Colonel Bertram Hopkinson, F.R.S., C.M.G.—Few of the gaps that the war has caused in the engineering world will be so difficult to fill as that which follows the loss of Colonel Bertram Hopkinson through a flying accident in north-east London on Monday last. Among the engineering professors of the day few were more distinguished or seemed to have greater careers before them. He was the eldest and last surviving son of the late Dr. John Hopkinson, F.R.S., who was killed in Switzerland in 1898. After that sad event, which many in the electrical world will remember so well, Bertram, who had been called to the Bar in the previous year, entered into consulting engineering partnership with Mr. Charles Hopkinson and Mr. E. Talbot, and various electric traction and other public works were carried through by them. About fifteen years ago Mr. Bertram Hopkinson became Professor of Mechanism and Applied Mechanics at Cambridge University, and in 1914 he was elected to a professorial chair at King's College. For some years Professor Bertram Hopkinson held a prominent and respected position in Section G. (engineering) at meetings of the British Association for the Advancement of Science, at which he submitted the gaseous explosions reports. For several years past Professor Hopkinson had been an officer in the Royal Flying Corps, and he had been in charge of experimental work for the R.A.F. for some time. He has laid down his life for the Allied cause in a branch of the service where his specialised knowledge could not fail to be of great value, but while his loss is deplorable on that account, it is equally regrettable on personal grounds, for he was a man of attractive personality and bore certain marked resemblances to his distinguished father. Colonel Hopkinson married the eldest daughter of Mr. Alexander Siemens in 1903. A military funeral takes place at Cambridge on Friday (to-day). A special train is being run from Liverpool Street Station at 11.50 a.m.

Obituary.—Mr. G. Simon Cullum.—Mr. G. S. Cullum, who has passed away, had for over 50 years been engaged at the Charlton works of Messrs. Siemens Bros.

TRADE STATISTICS OF NEW ZEALAND.

The following figures, showing the imports of electrical and allied goods into New Zealand in 1916, are taken from the official statistics which have recently reached this country. The figures for the previous year are given for purposes of comparison, and increases or decreases noted. In each year the country named is the country of origin of the goods.

	1915. £	1916. £	Inc. or dec. £
Leather belting.—			
From United Kingdom ...	4,000	4,000	—
,, United States	2,000	1,500	– 500
,, Other countries	2,000	2,500	+ 500
Total	8,000	8,000	—
Belting, other than leather.—			
From United Kingdom ...	22,000	39,000	+ 17,000
,, Australia	1,000	2,000	+ 1,000
,, United States	2,000	3,000	+ 1,000
Total	25,000	44,000	+ 19,000
Scientific instruments.—			
From United Kingdom ...	4,000	4,000	—
,, United States	1,000	2,000	+ 1,000
,, Other countries	1,000	1,000	—
Total	6,000	7,000	+ 1,000
Telegraph and telephone wires, iron.—			
From United Kingdom ...	9,000	1,000	– 8,000
,, United States	—	1,000	+ 1,000
Total	9,000	2,000	– 7,000
Engine packing.—			
From United Kingdom ...	11,000	13,000	+ 2,000
,, Australia	1,000	3,000	+ 2,000
,, United States	5,000	7,000	+ 2,000
,, Other countries	1,000	1,000	—
Total	18,000	24,000	+ 6,000
Generators, motors, and transformers.—			
From United Kingdom ...	44,000	46,000	+ 2,000
,, Germany	2,000	—	– 2,000
,, United States	26,000	38,000	+ 12,000
,, Other countries	2,000	2,000	—
Total	74,000	86,000	+ 12,000
Electric batteries and cells.—			
From United Kingdom ...	5,000	10,000	+ 5,000
,, United States	1,000	7,000	+ 6,000
,, Other countries	1,000	2,000	+ 1,000
Total	7,000	19,000	+ 12,000
Other electrical material.—			
From United Kingdom ...	67,000	78,000	+ 11,000
,, United States	30,000	52,000	+ 22,000
,, Australia	2,000	2,000	—
,, Sweden	4,000	1,000	– 3,000
,, Other countries	5,000	7,000	+ 2,000
Total	108,000	140,000	+ 32,000
Carbons and insulating material.—			
From United Kingdom ...	4,000	7,000	+ 3,000
,, United States	—	3,000	+ 3,000
,, Other countries	2,000	1,000	– 1,000
Total	6,000	11,000	+ 5,000

	1915. £	1916. £	Inc. or dec. £
Telephones and accessories.—			
From United Kingdom ...	—	13,000	—
,, United States	—	11,000	—
,, Other countries	—	1,000	—
Total	—	25,000	—
Meters, electricity.—			
From United Kingdom ...	8,000	12,000	+ 4,000
,, Other countries	1,000	2,000*	+ 1,000
Total	9,000	14,000	+ 5,000
* United States £2,000.			
Lamps, electrical.—			
From United Kingdom ...	23,000	29,000	+ 6,000
,, Holland	—	9,000	+ 9,000
,, United States	7,000	8,000	+ 1,000
,, Other countries	11,000	—	- 11,000
Total	41,000	46,000	+ 5,000
Steam engines.—			
From United Kingdom ...	13,000	11,000	- 2,000
,, United States	—	2,000	+ 2,000
Total	13,000	13,000	—
Boilers.—			
From United Kingdom ...	13,000	10,000	- 3,000
,, United States	2,000	—	- 2,000
Total	15,000	10,000	- 5,000
Gas and oil engines (except for motor cars).—			
From United Kingdom ...	43,000	41,000	- 2,000
,, United States	14,000	21,000	+ 7,000
,, Other countries	1,000	6,000	+ 5,000
Total	58,000	68,000	+ 10,000
Insulated cable and wire.—			
From United Kingdom ...	102,000	156,000	+ 54,000
,, United States	3,000	6,000	+ 3,000
,, Other countries	2,000	10,000*	+ 8,000
Total	107,000	172,000	+ 65,000
* Japan £9,000.			
Mining machinery.—			
From United Kingdom ...	15,000	11,000	- 4,000
,, Australia	2,000	3,000	+ 1,000
,, United States	15,000	6,000	- 9,000
,, Other countries	13,000	2,000	- 11,000
Total	45,000	22,000	- 23,000
Railway and tramway plant.—			
From United Kingdom ...	56,000	73,000	+ 17,000
,, Australia	4,000	10,000	+ 6,000
,, Other countries	1,000	11,000	+ 10,000
Total	61,000	94,000	+ 33,000

NEW COMPANIES REGISTERED.

Sheffield Ball Bearings Co., Ltd. (151,218).—Private company. Registered August 17th. Capital, £3,000 in £1 shares. Manufacturers of and dealers in ball and roller bearings, mechanical, electrical, motor and general engineers, etc. The subscribers (each with one share) are: P. Thomson, Ashfurlong, Dore, near Sheffield, retired Army officer; A. Fletcher, Summerley House, Instone, Sheffield, mechanical engineer. The first directors are: A. Fletcher, P. Thomson and W. Fowler. Registered office: St. James Chambers, 38, Church Street, Sheffield.

A. Lege & Co., Ltd. (151,226).—Private company. Registered August 20th. Capital, £2,000 in £1 shares. To take over the business of mechanical and electrical engineers and scientific instrument makers, carried on at 47, Lofting Road, London, as "A. Lege & Co." The subscribers (each with one share) are: Mrs. E. Lege, 11, Milner Street, Chelsea, S.W.; W. Jepson, 3, Walton House, Thane Villas, Holloway, N., engineer. The first directors are: W. Jepson, F. H. Bailey and A. E. Walker. Registered office: 47, Lofting Road, Islington, N.

Charles Winn & Co., Ltd. (151,156).—Private company. Registered August 10th. Capital, £50,000 in £1 shares. To take over the business of manufacturers of, and dealers in steam, gas and electric fittings, lamps, pumps, tools, etc., formerly carried on by the late C. Winn and P. Winn, in Birmingham, as "Charles Winn & Co." The subscribers (each with one share) are: P. Winn, 149, Granville Street, Birmingham, engineer; G. J. Withington, 29, Bowyer Road, Saltley, Birmingham, solicitor's clerk. P. Winn is governing director. Solicitors: Pinsent & Co., 6, Bennetts Hill, Birmingham.

Electro-Medical Treatment, Ltd. (151,203).—Private company. Registered August 16th. Capital, £3,000 in £1 shares. Objects as indicated by the title. The subscribers (each with one share) are: F. Sugden, 90, Dudley Road, Whalley Range, Manchester, produce merchant; E. O. Walker, 16, Wellington Road, Whalley Range, Manchester, electrical engineer. The first directors are: F. Sugden and E. O. Walker. Registered office: 12, Exchange Street, Manchester.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Faringdon Electric Light & Power Co., Ltd.—Notice of the appointment of W. A. Henderson, of 29, Gracechurch Street, E.C. 3, as receiver on August 9th, 1918, under powers contained in instruments dated February 11th, 1916, and August 25th, 1916, of first and second mortgage debentures, filed pursuant to Section 94 of the Companies (Consolidation) Act, 1908.

Portable Searchlight and Signalling Co., Ltd.—Notice of the appointment of E. J. Allcard, of 28, Throgmorton Street, E.C., as receiver, by Order of the Court dated July 26th, 1918, filed pursuant to Section 94 of the Companies (Consolidation) Act, 1908.

Fisher, Humphries & Co., Ltd.—Third mortgage debentures, dated July 29th, 1918, charged on the company's undertaking and property, present and future, including uncalled capital, to secure all moneys which may become payable under a guarantee to bankers by Col. H. Edzell, C.B., of Ystrad Mynach, and Col. A. P. James, of Cardiff.

Portable Utilities Co., Ltd.—Debenture dated August 2nd, 1918, to secure £1,600, charged on the company's undertaking and property. Holders: Electric Appliances Co., Ltd.

Hooper's Telegraph & India Rubber Works, Ltd. (49,947).—Capital, £50,000 in 1,000 preference and 4,000 ordinary shares of £10 each. Return dated July 23rd, 1918. 1,000 preference and 2,500 ordinary shares taken up. £25,000 paid on the ordinary; £10,000 considered as paid on the preference. Mortgages and charges: Nil.

Birmingham District Power and Traction Co., Ltd. (19,077).—Capital, £700,000 in £1 shares (250,000 preference and 450,000 ordinary). Return dated May 31st, 1918. 146,846 preference and 412,334 ordinary shares taken up; £559,780 paid. Mortgages and charges: £384,381.

Altrincham Electric Supply, Ltd. (40,795).—Capital, £50,000 in 49,650 preference shares of £1 and 7,000 deferred share of 1s. Return dated May 6th, 1918. 45,000 preference and 7,000 deferred shares taken up; £1 per share called up on 42,450 preference; 1s. per share on 2,550 preference and 1s. per share on 7,000 deferred shares; £42,297 10s. paid. Mortgages and charges: £45,000.

A. Hirst & Son, Ltd. (57,889).—Capital, £5,000 in 100 preference and 400 ordinary shares of £10 each. Return dated July 23rd, 1918. All shares taken up. £2,000 paid on 100 preference and 100 ordinary shares; £3,000 considered as paid on 300 ordinary shares. Mortgages and charges: Nil.

CITY NOTES.

Brown, Boveri & Co.

We referred in our issue of August 9th to the annual report and accounts of the Société Anonyme Brown, Boveri & Compagnie, of Baden, Switzerland, for the year 1917-18. Supplementing the information then given we learn from the directors' report that the company's sales in the home market were favoured by the importance which the utilisation of electrical energy has assumed in Switzerland under existing circumstances, although the establishment of new hydro-electric works does not proceed without many difficulties. In this respect present events demonstrate the manifest mistakes which 15 years ago caused nationalisation ideas for the equipment and working of the Swiss waterfalls to be extolled, and which thus arrested the development of private enterprise which was providing the country with cheap energy. Many works, the erection of which had been already assured, consequently remained merely as paper projects, and to-day their absence was not only seriously felt, but they can never be constructed on such favourable terms in the matter of prices. The report for 1916-17 made mention of a new driving system for electric locomotives, recommended by M. Tschanz, chief locomotive engineer of the Federal Railways, and it is now stated that the trials which are being continued on the Loetschberg railway, have fully answered expectations. Concerning the company's business with Russia, the report states that this came to a complete standstill, and it was to be feared that material losses might be incurred on the credits in that country. The prudence observed for a long time past in regard to increasing the risks incidental to Russia, however, would permit of the losses being borne without their reacting seriously on the balance-sheet. This state of affairs shows clearly the risks with which the industry has to reckon, and how essential it is for the firm to be always ready to meet them. This is why it is absolutely necessary that fiscal measures and the imposition of excessive taxes should not come further to restrict the industry's freedom of action and its resources to the point of even compromising its existence. Respecting the company's subsidiaries abroad, the report mentions that all of them are realising fairly satisfactory profits, which, however, are reduced by the large losses on exchange. All these companies are constantly endeavouring to develop their normal manufacturing branches, and they are succeeding, thanks to the continued relations which they maintain with the parent company and to the support rendered to them by the latter. This will certainly enable them, immediately after the war, to respond to the requirements of their respective markets, and ensure a sound basis for their future activity.

Belgian Companies.

The financial statement of *Siemens et Halske, of Brussels*, which is only now available for the year ended July 31st, 1917, exhibits gross profits of £3,340, as compared with £466 in the preceding year. The net profits amounting to £660 have been carried forward, as against £140 in 1915-16.

The accounts of the *A.E.G.-Union Electrique, of Brussels*, in which German capital is also interested, show a loss of £21 for 1917, as compared with a loss of £197 in the preceding year, on an ordinary share capital of £140,000. The loss, as well as the general expenses, has been defrayed out of the reserve fund.

The *Société Financière de Transports et d'Entreprises Electriques, of Brussels*, which is an investment company, 25 per cent. of whose ordinary share capital of £1,000,000 is said to be held by German banks and the A.E.G., reports net profits of £78,000 for 1917, being practically the same amount as in the previous year. A dividend of 7 per cent. has been declared, being the identical rate paid in each of the previous years of war.

The *Compagnie Générale de Railways et d'Electricité, of Brussels*, which is a holding company in Belgian and foreign transport and supply companies, received interest amounting to £48,000 in 1917, as contrasted with £51,000 in the preceding year. After meeting general expenses, providing for depreciation, and paying interest on the loan capital of £1,159,000, the balance of £700 has been carried forward, the ordinary share capital of £1,329,000 again not participating.

The *Société Belge d'Eclairage de St. Petersbourg, of Brussels*, announces the impossibility of submitting accounts for 1917, as was also the case for the preceding years of war. The company holds a concession for the lighting of a part of the Russian capital, although its works were taken possession of by the Russian authorities in May, 1917, and it is also interested in the Imatra Co., which proposed to transmit power to Petrograd from hydroelectric works utilising the power of the Wuoxen, Finland.

German Companies.

The directors of the *Elektro-technische Fabrik Rheydt Max Schorch & Co.* recommend a dividend of 20 per cent. for 1917-18, this contrasting with a rate of 15 per cent. in 1916-17.

The *Bau Ges. fur Elektrische Anlagen, of Aix-la-Chapelle*, reports net profits amounting to £10,000 for 1917-18, as contrasted with £8,600 in the preceding year. A dividend of 6 per cent. is proposed, being the same rate as in 1916-17.

The *Deutsche Magneta A.G., of Cologne*, manufacturer of electric clocks, reports net profits of £790 for 1917, as against £1,200 in the previous year. The former is carried forward, whereas the latter was devoted to the payment of a dividend of 5 per cent. for 1916.

The accounts of the *Wolfram Lampen A.G., of Augsburg*, show net profits and balance forward of £5,600 for 1917, as compared with £14,000 in the previous year. It is proposed to pay a dividend at the rate of 6 per cent. on the preference shares for each of the past three years, and transfer the balance to the next account.

The *Continentale Isola Werke A.G., of Birkesdorf, Duren*, after allocating £16,000 to depreciation in 1917-18, as against £13,000 in the previous year, reports net profits of £33,000, as compared with £27,000. It is intended to pay a dividend of 10 per cent., being the same rate as in 1916-17.

The report of the *A.G. fur Elektrizitats Industrie, of Hamburg*, states that it was possible further to extend the business in 1917-18, despite the scarcity and dearness of materials. The net profits were £5,200, as compared with £4,300, and the dividend is at the rate of 7 per cent., as contrasted with 6 per cent. in 1916-17, on a share capital of £50,000.

The accounts of *Menowsky & Co., of Porz on the Rhine*, makers of insulating materials, show net profits of £40,000 for 1917-18, as compared with £15,000 in the preceding year, the sum of £23,000 and £14,000 having previously been written off for depreciation in the two years respectively. The method of disposing of the profits is not disclosed; in 1916-17 a dividend of 9 per cent. was paid on the share capital of £150,000.

The *A.G. Korting Elektrizitats Werke, of Berlin*, reports an aggravation of the difficulties experienced in maintaining the various electricity works in operation in 1917-18 owing to the scarcity of skilled men and the use of inferior fuel, which resulted in interruptions in the working of the plant. After writing off £15,000 for depreciation, as in 1916-17, the accounts indicate net profits of £10,000, as against £10,700 in the previous year, and the directors recommend a dividend of 4 per cent., as in 1916-17.

Stock Exchange Notices.—The undermentioned securities are to be quoted in the Official List:—

Edison Swan Electric Co., Ltd.—100,000 first preference shares of £1 each, fully paid (Nos. 1 to 100,000).

Howard & Bullough, Ltd.—250,000 additional ordinary shares of £1 each, fully paid (Nos. 750,001 to 1,000,000).

Madras Electric Supply Corporation, Ltd.—6,000 additional ordinary shares of £1 each, fully paid (Nos. 180,001 to 186,000).

County of London Electric Supply Co., Ltd.—Interim dividend on the preference shares at the rate of 6 per cent. per annum, less income-tax, and on the ordinary shares at the rate of 5 per cent. per annum, less tax, for the June half-year.

Fraser & Chalmers, Ltd.—The secretary has issued a circular to shareholders stating that, according to the preliminary statement, in the negotiations with the General Electric Co., Ltd., the mining machinery section of the business was excepted from the arrangement. It was found, however, on drafting the sale agreement that the retention of the mining machinery business presented so many difficulties in definition that a modification of the whole basis of the sale had to be adopted. The agreement which is now completed provides for the transfer to the G.E.C. of the entire works at Erith and all the manufactures hitherto conducted therein, together with the goodwill. The scope of the Fraser and Chalmers operations in future is thus limited to the merchanting business. An offer has now been received from responsible parties for the purchase of the whole of the South African business which has in the past carried very large stocks of machinery and merchandise. That offer has been accepted provisionally, and when the sale is completed the company will be left with only the stocks of its branch offices in Australia, Canada and elsewhere, for disposal. The total sum receivable has not yet been ascertained and cannot be for some time. Later on a statement will be made, together with the directors' recommendations with regard to future policy.

New Issue.—The Fellows Magneto Co., Ltd., is offering to shareholders, at par, £40,000 capital in 8 per cent. cumulative participating preferred shares.

Waste Heat and Gas Electrical Generating Stations, Ltd.—Interim dividend of 2½ per cent., less income-tax, for the half-year ended July 31st, 1918.

Canadian General Electric Co., Ltd.—Quarterly dividend of 2 per cent. on the Common stock.

STOCKS AND SHARES.

Tuesday Evening.

Conditions of Stock Exchange business remain much the same as they were last week. In some directions activity has shaded off, this applying to the electrical manufacturing shares which were given a good run earlier in the month, and the interest in which has now died down to some extent. This is explained in the market by reference to the holiday season, and to the fact that prices have risen sufficiently high to check fresh purchases, while, at the same time, previous buyers are not averse from taking profits. Therefore, Ediswan "A" shares have come down from 51s. to 47s. 6d., British Westinghouse preference from 31/16 to 2¼, and so on down the list. At the same time, the reactions have been small as compared with the previous rises, and in some cases prices are extremely well held, an illustration being afforded by Electric Constructions, which keep hard at 27s. 6d.

Dealings have just started in the bonus shares of the General Electric Co., so that at the present time there are three classes of ordinary shares being dealt in. There are the old ordinary, standing at 18¼, the new bonus shares, at 17¼, and the new shares which were offered for public subscription, and which stand at 5 premium. Those who wish to buy or sell General Electrics should make a point of specifying which issue they wish to deal in, otherwise there is scope for mistakes and friction. The new preference shares stand at 1/16 premium, and the market in the various issues is described as being a firm one.

The conclusion of the 'bus strike was marked by rises in several of the Underground issues. Districts and Metropolitans both advanced, but the full extent of the rise was not maintained. Activity in Underground Electric Railways of London descriptions has given way to a more placid market, and because of this and a certain amount of profit taking, the quotations are rather easier, 'Bus "A," for instance, being 8s. There is not much doing in the list of steam stocks, and the inactivity is a disappointment to those who were hoping that the strength of gilt-edged issues, fostered by the splendid news from the Western Front and the advances in Consols, War Loan, &c., would be extended to Home Rails. No doubt the public are disposed to view very warily the outlook in regard to labour, and for this reason are not eager to put money into the railway stocks at present.

There has been a further move-up, followed by reaction, in Mexicans. The recent raising of the export duty on oil can scarcely fail to make substantial difference to the revenue of the country, and this, it is held, will react favourably upon all Mexican industries. On the strength of these arguments, Mexican utilities were put up in price, though here again the strength evaporated, and prices gave way from the best. On the week there is not much change, and the big rises secured some ten days ago have mostly been held. Other foreign stocks are inclined to improve, and advances have been scored by Rio de Janeiro first mortgage bonds at 89 and by San Paulo bonds at 91. The firmness of Anglo-Argentine Tramways is also worth mentioning. Brazilian Tractions rose to 46. Bombay Electric preference have had a mysterious rise of 30s. to 10¼.

The market in English electricity supply shares remains dormant. Indeed, it might almost be worth while having

this sentence set up as a standing contribution to our weekly article. Debenture stocks and preference shares are as scarce as ever. The County of London Electric has declared an interim dividend on the ordinary shares at the rate of 5 per cent., which is the same as that of a year ago. The preference shares have weakened ¼, and so have City preference, though the ordinary shares in the latter company are a similar fraction to the good.

The telegraph and telephone market is firm as a whole, and Globe preference stiffened to 10½. Westerns rose 5s. to 16⅝, but some of the shares in which there has been a fair amount of speculative business doing recently, have reacted. West India and Panama, for instance, lost 3/16 of their previous 9/16 advance, and Marconis at 3¼ are 5s. down. American Marconis keep tolerably steady at 27s. Interest in the group as a whole has ebbed to some extent, and there has been a good deal of profit-taking.

India Rubber shares continue their steady rise, this week's gain being 10s., and Telegraph Constructions at 45½ are equally higher. British Insulated rose to 2½. Babcock and Wilcox keep about 3⅞, and British Aluminium, after a decline, recovered to 40s. Fraser & Chalmers have issued a long circular with reference to the taking-over of the company by the General Electric. In brief, the proposals amount to a sale of the Fraser & Chalmers' assets, the bulk of them going to the General Electric, and by degrees the company will be dissolved. The price of the shares hardened to 32s. 6d. on the announcement. Rubber shares continue to dwindle in price. Indian gold mining shares have stiffened by reason of the statement just issued showing what substantial economies have resulted from the introduction of a large scale some years ago of electrical installations. In other mining sections there is not much doing.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Aug. 27. 1918.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	9	10	6⅜	—	£7 17 0
Charing Cross Ordinary	5	4	3¾	—	6 8 0
do. do. 4½ Pref.	4½	4½	3⅞	—	6 18 6
Chelsea	3	5	3½	—	7 13 10
City of London	8	8	11¼	+ ¼	6 19 2
do. do. 6 per cent. Pref.	6	6	9⅞	— ⅛	6 3 1
County of London	7	7	10¾	—	6 17 7
do. do. 5 per cent. Pref.	6	6	9⅞	— ⅛	6 1 6
Kensington Ordinary	6	7	5¾	—	6 17 7
London Electric	Nil	Nil	1½	—	Nil
do. do. 6 per cent. Pref.	4	5	3½	—	7 13 10
Metropolitan	3	4	3¾	—	6 8 0
do. 4½ per cent. Pref.	4½	4½	3⅞	—	6 18 6
St. James' and Pall Mall	8	9	6¾	—	7 1 2
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	21/-	—	6 13 4
Westminster Ordinary	7	9	5¾	—	7 13 3
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	97½	—	6 3 0
do. Def.	1½	1½	23⅜	—	6 7 8
Chile Telephone	8	8	7½	—	5 6 8
Cuba Sub. Ord.	7	7	10	—	*7 0 0
Eastern Extension	8	8	15⅛	—	*5 3 3
Eastern Tel. Ord.	8	8	158½	—	*5 1 0
Globe Tel. and T. Ord.	7	7	14⅜	—	*4 17 5
do. do. Pref.	6	6	10½	+ ⅛	5 17 1
Great Northern Tel.	24	22	87½	—	5 17 4
Indo-European	13	—	57½	—	5 12 6
Marconi	15	20	3¼	— ¼	5 3 3
Oriental Telephone Ord.	10	10	3⅛	—	3 4 0
United R. Plate Tel.	8	8	7½	—	*5 6 8
West India and Panama	6d.	9d.	1⅛	— 3/16	*2 2 0
Western Telegraph	8	8	16⅜	+ ¼	*4 17 9
Home Rails.					
Central London Ord. Assented	4	4	62½	—	6 8 0
Metropolitan	1	1	27	+ ½	3 14 1
do. District	Nil	Nil	24	+1	Nil
Underground Electric Ordinary	Nil	Nil	2⅞	— ⅛	Nil
do. do. "A"	Nil	Nil	8/-	—3d.	Nil
do. do. Income	6	4	85½	—	*4 13 6
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	42	—	6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	3⅛	+ 1/16	—
do. do. 2nd Pref.	5½	—	2⅜	—	—
do. do. 5 Deb.	5	5	66	—	7 12 2
Brazil Tractions	—	—	46	+ ½	—
Bombay Electric Pref.	6	6	103½	+1¼	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	60½	— 1	8 5 4
do. do. Preferred	Nil	Nil	44	— 1	Nil
do. do. Deferred	Nil	Nil	39½	— 1	Nil
do. do. Deb.	4½	4½	60½	—	7 9 6
Mexico Trams 5 per cent. Bonds	Nil	Nil	50	—1	Nil
do. 6 per cent. Bonds	Nil	Nil	42	—	Nil
Mexican Light Common	Nil	Nil	27	+1	Nil
do. Pref.	Nil	Nil	41½	—2	Nil
do. 1st Bonds	Nil	Nil	54½	—2	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3⅞	—	3 17 2
British Aluminium Ord.	10	10	2	—	5 0 0
British Insulated Ord.	20	20	2½	+ ½	4 14 1
British Westinghouse Pref.	7½	7½	2	— ⅛	5 9 1
Callenders	20	25	11½	—	6 4 6
do. 5 Pref.	5	5	4½	—	5 17 8
Castner-Kellner	22	20	3⅝	—	5 10 4
Edison-Swan, fully paid	—	—	8½	—	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	10	1⅜	+ 1/16	7 5 6
Gen. Elec. Pref.	6	6	10½	—	6 5 4
do. Ord.	10	10	18½	— ½	*5 8 1
Henley	25	25	3½	—	5 16 0
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	17½	+ ½	*5 16 9
Telegraph Con.	20	20	45½	+ ½	*4 5 3

*Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, August 28th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/6	..
a Ammoniac Sal	per ton	£100	£20 inc.
a Ammonia, Muriate (large crystal)	"	£75	..
a Bisulphide of Carbon	"	..	..
a Borax	"	£48	..
a Copper Sulphate	"	£85	..
a Potash, Chlorate	per lb.	2/4	2d. dec.
a " Perchlorate	"	3/-	..
a Shellac	per cwt.	£17 5/-	..
a Sulphate of Magnesia	per ton	£15	..
a Sulphur, Sublimed Flowers	"	£35	..
a " Lump	"	£25	..
a Soda, Chlorate	per lb.	1/1	..
a " Crystals	per ton	170/-	..
a Sodium Bichromate, casks	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2' to 12' basis)	per lb.	..	..
c " Tubes (solid drawn)	"	..	..
c " Wire, basis	"	..	..
c Copper Tubes (solid drawn)	"	1/8½ to 1/9	..
g " Bars (best selected)	per ton	£161	..
g " Sheet	"	£161	..
g " Rod	"	£161	..
d " (Electrolytic) Bars	"	£137	..
d " " Sheets	"	£161	..
d " " Wire Rods	"	£145	..
d " " H.C. Wire	per lb.	1/6½	..
f Ebonite Rod	"	3/-	..
f " Sheet	"	2/6	..
a German Silver Wire	"	2/6	..
h Gutta-percha, fine	"	6/10	..
h India-rubber, Para fine	"	3/3	3d. inc.
i Iron Pig (Cleveland warrants)	per ton	Nom.	..
l " Wire, galv. No. 8, P.O. qual.	"	£37	..
g Lead, English Pig	"	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small	per lb.	6d. to 3/-	..
e " " " medium	"	3/6 to 6/-	..
e " " " large	"	7/6 to 14/- & up.	..
d Silicium Bronze Wire	per lb.	1/10	1½d. inc.
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	"	..	..
n " Wire, Nos. 1 to 16	per lb.	5/-	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

Protecting the Panama Lock Valves against Electrolysis.—Electrolytic corrosion, acting in an unexpected manner, caused serious damage to the valves in the Panama Canal locks, and threatened to put them out of service in a period much shorter than that for which they were designed. There is in the behaviour of these valves a lesson which has application to numerous metal structures subject to the action of salt water. The flow of water in the culverts of the locks is controlled by sets of valves which during operation are always immersed in more or less salty water. After 15 months it was discovered that corrosion caused by galvanic action owing to the presence of different metals in salt water had caused considerable pitting in some of the valves, the rivets being partially eaten away in some cases. It was decided to paint with bitumastic solution and enamel nine of the valves. In 1916 some valves which had been immersed for approximately two years and four months were removed. Inspection showed deterioration, not only of the valve, but of the fixed irons as well. The bottom babbit seat in which the valve rested was removed and wooden seats of greenheart were placed in the fixed irons. The removable side steel strips had been so badly eaten away by action with the bronze seals on the valve that they no longer came in contact with them, and tests showed that the leakage had increased to nine times normal in about six months. It was decided to replace the steel strips with strips of lignum vitæ. The lead used for caulking the fixed irons and for leading in bolts was replaced with cement. Zinc electrodes were placed at the bottom of the bronze seals to assist in overcoming action between the bottom of the valve and the seals. All parts of the valves, with the exception of the bronze seals and rubbing surfaces, as well as the fixed irons, were coated with bitumastic solution and enamel. To protect the bearing surfaces, pipes have been placed leading from the operating tunnel to below the roller trains in the culverts, with the intention of forcing crude oil through these pipes, in the expectation that when the oil rises through the water it will come in contact with the rollers and bearing surfaces and adhere to them, lubricating them and protecting them from further corrosion.—*Engineering News-Record*, June 27th.

TURBINE HOUSE PLANT OPERATION.

By T. G. OTLEY, M.I.E.E., and V. PICKLES, A.M.I.E.E.

(*Abstract of paper read before the* South African Institute of Electrical Engineers, *May*, 1918.)

We propose in this paper to discuss some of the salient points connected with the efficient operation of turbine plant and its attendant auxiliaries. These have particular reference to the plant installed in the power stations of the Victoria Falls and Transvaal Power Co. and the Rand Mines Power Supply Co., Ltd., a subsidiary company of the Victoria Falls Co.

The following schedule shows the number and size of the turbines installed at the four steam stations—Rosherville, Simmerpan, and Brakpan—situated along the reef from west to east, and Vereeniging Power Station situated on the Vaal River, about 36 miles south of Johannesburg. All four stations feed into a common network.*

Main Turbines.

		Maker's normal ratings. KW.	Revs. per minute.	
Rosherville	...	5× 9,600	1,000	turbine generators.
,,	...	5× 3,000	3,000	turbine compressors.
,,	...	3× 7,000	3,000	,, ,,
Vereeniging	...	2×12,000	1,000	turbine generators.
,,	...	2× 9,600	1,000	,, ,,
Simmer Pan	...	2×11,000	1,500	,, ,,
,,	...	5× 3,000	1,500	,, ,,
Brakpan	...	2×12,000	1,500	,, ,,
,,	...	2× 3,000	1,500	,, ,,
,,	...	1× 1,500	3,000	turoine compressor.
,,	...	1× 3,000	3,000	,, ,,
Total	...	31 203,700 KW.		

There are also three steam reciprocating air compressors installed at Brakpan, and 47 small turbines for driving condensing auxiliaries and feed pumps at the various stations.

In the turbine house we are concerned with two efficiencies, namely, turbine and steam efficiencies.

Within the usual working range the performance of a steam turbine follows Willans's law, that is, the relation between the total energy put in and the total energy got out is a straight line of the form $y=a+bx$, where the ordinates are total steam KW. and the abscissæ total electric KW. The former figure is obtained by multiplying the total lb. of steam used per hour by the available energy in KW.-hrs./lb. It will be noted that we have used the expression KW.-hrs./lb. as being more convenient for use in connection with power station working than the more usual B.TH.U. or calories. We use a modified Mollier diagram with the energy scale divided into KW.-hours instead of the more usual form.

The Willans line for each machine is obtained by test, the load being maintained constant and other conditions as steady as possible. In nozzle-governed machines there is no appreciable departure from this line in commercial working, but in throttle-governed machines there is. This is because the pressure is measured before the throttle valve, and hence the energy available for work in the turbine is not always correctly returned. There is also a slight change with the temperature of the circulating water. With steady working conditions, however, the line is practically straight from no-load to a reasonable overload. It is a striking fact, and contrary to what one might reasonably expect, that the condition of the blading can deteriorate to a very considerable extent without materially affecting the efficiency of the turbine, and maintenance in the way of reblading is usually dictated more by considerations of safety than of efficiency, that is to say, before the blading has deteriorated to such an extent as to affect the efficiency of the machine, it has probably become unsafe to run. A number of tests have been made with old and new nozzle segments and guide and moving blades, which, when taken out, appeared to be on the point of breakdown, but which, when renewed, made no appreciable difference in the efficiency of the machine.

If any qualification in the above general statement is necessary, it is that the condition of the blading in the L.P. stages is of greater importance than in the H.P. portion of the machine, because losses at the H.P. end may be in part recovered at the L.P. end. In putting forward these views we have particularly in mind the Curtis-Rateau type of machine. The question of maintenance of blading is also affected by coal costs and load factor; the higher these factors the greater is the money value of any loss in efficiency. It becomes therefore a question of simple arithmetic as to how far a machine may be allowed to deteriorate.

Within the range over which a turbine is commercially operated its efficiency rises with the load it carries, but it does not follow that it is most economically loaded at its normal full rated capacity. Maximum economy is reached when the product of turbine and steam efficiencies is greatest, and as the steam efficiency falls with a rising load, this product may be greatest at some point below its full rated capacity. In general, however, we may assume that it pays in all cases to run with as high a plant load factor as possible.

Steam efficiency is the variable which has to be given the greatest attention. This is determined by the inital and final conditions of the steam, and is therefore dependent on boiler house operation and the efficiency and maintenance of the condensing plant. Steam is supplied to our turbines at a pressure of approximately 200 lb./sq. in. with boiler pressures of 220-240 lb./sq. in., and a temperature of 320 deg.-360 deg. C. The pressure is somewhere near the limit imposed by the design of the plant, while the temperatures are as high as we can safely work at.

It has been found by test on one of our Vereeniging sets that the over-all efficiency is affected to the extent of 1 per cent. by a change of one atmosphere in the steam pressure. Another series of tests to ascertain the effect of steam temperature shows that the over-all efficiency is improved by 1 per cent. if the initial temperature of the steam is increased by 7 deg. C. Part of the gain in this case is due to improvement in turbine efficiency and part to an increase in steam efficiency. The results of these tests are quoted as confirmation of the importance of supplying turbines with steam at as high a pressure and especially at as high a temperature as practicable.

With the exception of the six 3,000-KW. machines at Simmer Pan and the two 3,000-KW. machines at Brakpan, all the condensing auxiliaries are steam turbine driven. There is no doubt that the efficiency of this arrangement is at least equal to that of electrically driven auxiliaries, and it is certainly more reliable in times of trouble. All the condenser auxiliary turbines are designed to take steam at full pressure and temperature, and to exhaust into the space between the last row of the Curtis wheel and the diaphragm carrying the first row of Rateau guide blades of the main turbine. This arrangement is satisfactory, and gives no trouble, but unless the auxiliary turbine is designed on liberal lines it has the serious disadvantage that as the load on the main machine increases and the intermediate steam pressure becomes higher the back pressure on the auxiliary turbine also increases, with the result that the speed of the pumps tends to fall and less water is passed through the condenser.

From a mechanical point of view, we have experienced singularly little trouble with our condensing plant, except in the case of the two condensers for the 12,000-KW. generators at Vereeniging. These each have 4,162 tubes 21 ft. 6¼ in. long of the standard diameter 23-21 mm. There are two centre stay plates across the length. The trouble took the form of the tubes wearing down very badly and becoming perforated where they were held by the stay lace packing, this resulting in a very considerable leak into the steam space, which necessitated the machines being frequently taken out of commission for renewal or plugging of condenser tubes. The cause of the perforation was vibration caused by the impact of the steam among the top nest of tubes, the trouble being confined to the top half of the condenser. The remedy that we have decided upon is to remove the top third of the tubes and rethread them through the centre tube plates one hole out of pitch vertically so that each tube is slightly hogged. We believe that this arrangement has proved satisfactory where similar trouble has been experienced.

As an example of how not to do it, we may quote the case of a 4,000-H.P. turbine compressor intercooler where similar trouble was experienced. The tubes in this case were expanded into the tube plates, and in order to overcome the vibration trouble the contractors (A.E.G., Berlin) expanded the tubes into the centre tube stay plate, using a special tool for this purpose. It can be imagined, when these tubes had to be replaced, as, ultimately, a number of them had to be, what difficulty was experienced as a result of this impracticable and barbarous remedy.

We have also experienced some difficulty due to the condenser tubes bulging inwards, as a result of the ferrules being tightened down on the stay lace packing. All the condenser tubes are 23-21 mm. diameter, the walls being 1 mm. thick. As a result of this it has been found almost impossible to keep the condensers tight for any length of time. This has been overcome by very lightly expanding the condenser tubes into the ferrules so as to make a metal to metal joint. The expansion is not carried so far as to prevent the ferrule being turned and tightened down on the packing, but it was found unnecessary to screw them down as tightly as before, and since adopting this practice the condensers have remained almost absolutely tight. We pay particular attention to condenser leakage, every condenser on the system being tested three times a day by means of a Dionic water tester.

Some eighteen months ago a factor was introduced into our returns which we call the condenser coefficient. This factor is one of vital importance in power station economy. The steam energy available for work on the turbine is the difference between the energy in the steam at the stop valve and the energy in the steam at the exhaust. The energy that has to be supplied by the coal is the difference between the steam energy at the stop valve and the energy of water of the temperature of the exhaust. This assumes that the condensate is used for boiler feed purposes. The operating engineer should endeavour to keep his condensers in such a condition that the available energy is the biggest fraction of the energy to be supplied by the coal.

* These stations were described in the Electrical Review, March, 1913.—Eds.

Assuming iso-entropic expansion, we can, from the Mollier diagram, obtain the values for the following ratio:—

$$\frac{\text{Energy to be supplied by coal}}{\text{Available energy}} \quad \text{.....Ratio 1.}$$

If we assume the condenser to be of infinite capacity, then the exhaust temperature will be the same as the inlet temperature of the circulating water and the available energy will be consequently greater. The ratio

$$\frac{\text{Energy to be supplied by coal}}{\text{Available energy}} \quad \text{.....Ratio 2.}$$

will therefore be less.

It is found that the difference between these ratios is proportional to the output of the generators, or

$$\text{Ratio 1} - \text{Ratio 2} = d \times \text{output}$$

where d is a constant depending on the design of a condenser and its auxiliaries. We may write this equation

$$\text{Ratio 1} = \text{Ratio 2} + d \times \text{output}$$

and the left-hand side then represents the observed value of the ratio, while the right-hand side is the standard value derived from the circulating water temperature and the machine load.

When a condenser and its auxiliaries are in their best condition, we may write

$$\frac{(\text{Ratio 1})}{(\text{Ratio 2} + d \times \text{output})} = 100$$

from which d may be found.

In any future calculation of results obtained in ordinary running or test and using the same constant d, any departure from the best condition will be given as a percentage of such condition. Further, the figure returned reflects the variation as a percentage of actual efficiency, that is, if the figure becomes 101 it means that we are losing 1 per cent. in our coal bill. This is easily seen, for the only variable with condition is ratio 1. It will be remembered that this ratio is

$$\frac{\text{Energy to be supplied by coal}}{\text{Available energy}}$$

and as in this ratio the variable is the available energy, it follows that a 1 per cent. increase in the coefficient can only be a result of a similar decrease in available energy.

We have found that this condenser coefficient is unaffected by circulating water temperature or variations in load. It is not only an absolutely reliable guide as to the condition of a condenser or its auxiliaries, but, as already shown, it gives us directly the influence on the coal bill of any departure from the best condition. This item is one of the most valuable that appears in our returns, and we take this opportunity of publicly acknowledging the indebtedness of the power company to Mr. G. M. Clark who was responsible for its introduction when in charge of the research department of the company.

The circulating water at different stations does not affect the condensers in the same way. At Simmer Pan and Rosherville the inside of the tubes becomes coated with a slimy deposit, which, although not difficult to remove, affects the vacuum very quickly and materially. The water at Vereeniging contains particles of sand which scour the inside of the tubes and keep them clean. At Brakpan the capacity of the dam at the station is small, about 20,000,000 gallons, and in order to keep the temperature down, a spray cooling plant was installed in conjunction with the latest extensions—two 12,000-kw. generators. The evaporation and loss due to drifting, &c., from this cooling plant is estimated to be in the region of 1 per cent. of the total circulating water, equivalent to about 30,000 gallons per hour. As the make-up is by no means pure, the water rapidly concentrates and becomes scale forming. It was thought that if the average mean inlet temperature could be reduced, scale formation might also be reduced or disappear, and steps were taken to increase the spray nozzle plant, which had the result of reducing the temperature by about 4 deg. C., but this had little effect on its scale forming characteristics. Further steps were taken, namely, treating the whole of the 20,000,000 gallons of water contained in the dam, and a water softener of a capacity of 10,000 gallons per hour was provided. About 200,000-240,000 gallons per day were passed through this purifier, the treatment resulting in a simple exchange of the scale forming salts for soluble salts. The effect was extremely satisfactory, but the rate of treatment was relatively slow, especially bearing in mind that 40,000 gallons per hour of make-up was necessary for the dam. It was then decided to accelerate the action by adding sodium bi-sulphate. This is an acid, the action of which is to neutralise the alkalinity of the water, and has been so far successful as to reduce the scaling to a negligible amount.

Curves prepared from the Brakpan returns show the variations of the condenser coefficient during the years 1916 and 1917. Duding the last six or seven months the condenser efficiency has been consistently better than in the earlied period. This improvement is a direct result of treating the dam water. Between October and November, 1917, the condenser coefficient of machines 2, 3, and 4 began to rise. This arose through our endeavour to utilise for cooling purposes the enormous volume of water which had accumulated in the outer pan. The inner pan was allowed to overflow and cold outer pan water pumped back to reduce the temperature of the inlet circulating water. This practice rendered it almost impossible to effectively treat the water by the purifier or by adding bi-sulphate, and as a result, scale began to form and the condenser coefficient rose as stated. The saving due to reduction in circulating water temperature was more than neutralised by the rapid scaling up of the condensers.

With regard to condenser circulating water, in our returns an item which we call W/Tr. is inserted. This is the weight of the condensate divided by the rise in temperature of the circulating water across the condenser. If the state point of the steam at exhaust were constant, this figure would be proportional to the quantity of circulating water passing through the condenser. As this is not the case, however, the figure is not an absolute guide, but when the steam conditions and load are retained approximately constant, it gives a very good idea of the quantity of circulating water being pumped through the condenser.

Condenser cleaning is much the most important controllable factor in condenser efficiency. The usual method is to take off one of the end covers and push a wire brush through the tubes, following this up with a jet of water to wash out any loose mud that may still adhere. This method, while fairly effective, is both inconvenient and relatively expensive. It has been superseded by the compressed air and the rubber disk method recently described before the sister institution, which has so far proved very successful.

(To be concluded.)

THE BRITISH SCIENTIFIC PRODUCTS EXHIBITION.

(Continued from page 178.)

Igranic Electric Co., Ltd., London.—The exhibit of this company was briefly mentioned in our last issue; we are now able to give some further particulars regarding it. The "Igranic" patent ironclad motor starting panel, fig. 1, presents some entirely new developments in this class of apparatus. A self-acting motor starter of the multiple finger pattern, and two single-pole main-contactor switches are mounted together (and interlocked) inside a very strong iron housing having a junction box at the base, and an ammeter at the top. A large

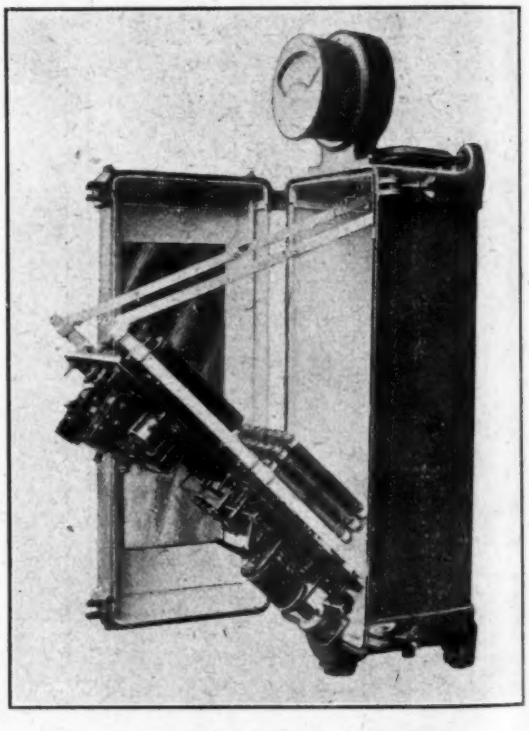


Fig. 1.—"Igranic" Ironclad Motor Starting Panel.—swung forward for inspection.

window in the front of the housing gives a clear view of the switch parts, but when a closer inspection is required, the whole front of the box can be swung open on hinges, thus enabling an attendant easily to clean or adjust the switch-gear. A specially valuable and quite novel feature is that access can be gained to the resistances and all internal parts of the apparatus by simply loosening two winged nuts on the top of the housing and pulling the panel forward, without the necessity of breaking any electrical connections. When pulled

forward in this way the whole panel comes out of the box, exposing the resistances and everything else that is mounted behind the slate. This makes inspection and repair exceedingly easy, and it is equally easy to replace the panel by simply pushing it back into the box and securing it by the two winged nuts formerly mentioned. Any type or combination of switchgear may be housed in this patented manner, and all parts can be readily inspected as already described.

On the back of the exhibition panel a number of control devices are fitted to demonstrate the operation of the self starter when employed for various purposes. These devices include automatic control by thermostat, float switch, pressure regulator, vacuum regulator, and by push buttons.

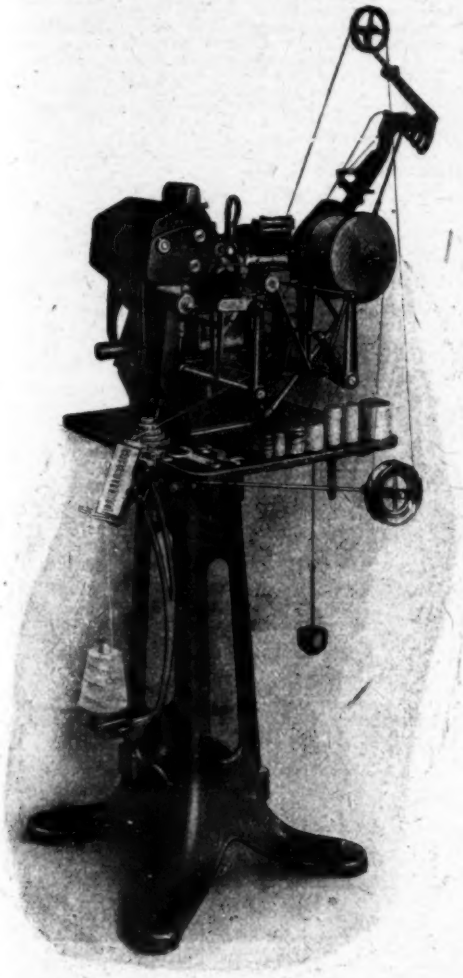


Fig. 2.—"Leesona" Coil-winding Machine.

Included in the exhibit are a number of electromagnet coils wound on the "Leesona" universal coil winding machines, which are capable of producing a wide range of extremely reliable coils, having high space factor and being uniform in all respects. The coils are produced quickly and at low cost, and their construction is such as to render efficient impregnation a simple process. No. 84 machine (fig. 2) winds cross-wound coils for magnets, &c. Cotton or silk-covered wire is wound in layers; each turn is laid at an angle to the axis of the coil, so that each layer is at an angle to the layer below. The advantages of this method of winding are, first, practically zero capacity between the layers and a little less inductance, making an ideal coil for high voltages; secondly, this form of winding is entirely self-supporting, requiring no flanges or heads to support the coil either during winding or in use. Coils as narrow as 3/16 in. and several inches in diameter can be wound without the use of side support; when finished the windings admit of easy impregnation. This machine is practically automatic; a device automatically controls the delivery of the finest wire from the supply spool to the coil, and prevents kinking, entangling, or stretching of the wire. A brake mechanism stops the winding spindle instantly if the wire breaks, also the spindle is stopped by an automatic counter when the desired number of turns have been wound. These automatic devices make it possible for one operator to control several machines.

No. 96 machine is adapted for winding coils for meters, transformers, and relays, as well as field coils, &c. The turns are parallel to each other and in a plane at right angles to the axis. A fine cotton yarn is wound simultaneously with the wire. The yarn is interwoven with the wire, which may be either enamelled or insulated with silk or cotton, also the form and flanges are automatically built up of cotton during the winding process. The plane of the wire convolutions is at right angles to the axis of the coil, while the plane of the cotton strands lies at a different angle to the axis, the entire mass being bound or woven together so that the finished coil is practically indestructible either from internal or external stress. Furthermore, during the winding the yarn is being

Figs. 3 and 4.—"Leesona" Coils.

distributed over the area of the coil at a faster rate than the wire, thus when a layer of wire is completed there is also a layer of cotton over it so that the next layer of wire is separated from the previous layer. This machine is equipped with the automatic device previously referred to, and consequently the coils may be duplicated with great facility.

The Micanite & Insulators Co., Ltd., Walthamstow. This firm is exhibiting specimens of British produced insulating cloths, &c., manufactured in its new factory at Walthamstow. Although in the past large quantities of these materials have been imported from the firm's American factory, manufacture has now been going on for several months at Walthamstow, and the output of this material will shortly be increased threefold. The firm's exhibits include "Paxolin" insulating materials, which materials are built up of paper impregnated with varnish made from the condensation product of phenol and formaldehyde. Samples of standard and Admiralty quality "Paxolin" plates, sheets, cylinders, and tubes are shown. Also insulating accessories are on view showing how this material can be drilled, tapped, threaded, sawn, turned, and planed. Included are also samples of "Empire" oiled insulating cloth and paper, and various micanite manufactures.

Automatic and Electric Furnaces, Ltd., London.—This firm is exhibiting the Wild-Barfield electric furnace which takes work 7½ in. in diameter, 12 in. in length, and a maximum weight for each article of 10 lb. The furnace is designed for the automatic hardening of carbon steel, the output of work per hour being approximately 30 lb. Its principal features are: The critical point is accurately and automatically determined, so that the desired degree of hardness is obtained and the human error is entirely eliminated. The work can be left in inexperienced hands, uniform heating is attained, and the grain obtained is of the finest, no matter what the carbon content of the steel may be. The current consumption and cost are exceedingly small, the maximum power consumption being 4,200 watts. The amount of distortion is reduced to a minimum, amounting generally to not more than 0.0001 in., there are no products of combustion and no oxidisation of the work, and the heat losses are small, involving no special ventilation arrangements.

In addition to the furnace, a Wild-Barfield electrically-heated salt quenching or tempering bath for use in connection with the furnace is shown, as is also a Wild-Barfield patent electric muffle, with pyroscopic detector, galvanometer, compensator, condenser and scale, and resistance for regulating the temperature. (See Elec. Rev., March 1st and June 28th, 1918.)

Messrs. Sims Motor Units, Ltd., London.—This exhibit consists of magnetos of the high-tension type in which the current is generated directly in the winding of the rotated armature without the use of a separate induction coil. The machine is of small dimensions, and it will give an effective spark at the plug at the lowest possible speed of the motor with the timing lever in any position. Other exhibits are magneto spare parts, sparking plugs, and several forms of magnetic petrol gauges for motor car tanks. This is claimed to be the only magnetic gauge that can be attached to either the side or the end of a rectangular or cylindrical tank. It may be screwed, fluid tight, into a flange bushing set into the tank, and it is proof against the effects of air, damp or dust. The gauge is made for both pressure and gravity tanks, the amount of pressure makes no difference, and taking the form of a hollow metal float which is tested to a pressure of 100 lb.; this is threaded on a gun-metal bronze ribbon, which is suspended from the gauge, and to which is attached a permanent magnet. The bronze ribbon passes through a

tube in the centre of the float, and as the latter passes up and down with the rise and fall of the liquid, it is turned by a spiral cut in the tube. This causes the metal ribbon to make a turn, which turns the magnet also. The magnet exercises its power through the solid head of the gauge, and turns the magnet hand on the dial to correspond with the level of the petrol.

(To be continued.)

THE AYLESBURY ELECTRICITY UNDERTAKING.*

By W. A. TURNBULL, A.M.Inst.C.E., A.M.I.E.E., WH. EX., Borough Electrical Engineer.

(Abstract of paper read before the Institution of Municipal Engineers, *August 24th,* 1918.)

The electricity works are situated near the centre of the town, by the side of the canal, where there is the necessary ample supply of cheap cooling water. The plant consists of two 100-kw. vertical three-line Diesel oil engines and one 200-kw. four-line horizontal suction gas engine. In conjunction with this generating plant is a storage battery, capable of supplying 40 kw. for a period of ten hours.

After an amount of experimenting with the use of tar oil (creosote) as fuel, we were able under certain conditions to start constant running, in August, 1916, on tar oil. Aylesbury being the first Diesel-engine station to start this use of tar oil. Up to February of this year, £996 had been saved on the fuel bill, due to the use of this fuel. The chairman of the Electricity Committee (who is an engineer) must take the great amount of the credit for this remarkable result.

In connection with the gas engine, the gas obtained gives the following analysis :—

CO_2.	O.	CO.	CH_4.	H.	N.
7 %	1·5 %	23 %	1 %	24 %	44·5 %

and has a calorific value of 145 B.TH.U. per cb. ft. An eight-hour full-load test on the engine with anthracite peas gave a consumption of 1·2 lb. per kw.-hour.

The average fuel consumption for the past few months has been 1·5 lb. per unit, including all losses. The present fuel costs for the gas and Diesel engines are as follows :—

Gas engine, coal 1·5 lb. per unit, 40s. ton	·32d.
Diesel engine, tar oil ·65 lb. per unit, 100s. ton ·38d. American oil ·08 lb. per unit, 300s. ton ·13d. ...	·51d.

This saving of ·2d. per unit at the present time represents a saving on our fuel bill of about £500 per annum, and the saving would be greater if a large amount of the output had not to be made up by the use of the Diesel engines.

There are 16 miles of cable laid in the town, the supply being laid on to all the street lamps. From the works, five-feeder cables run to five different areas of the town, terminating in cast-iron feeder pillars. The whole of the cables are paper-insulated, lead-covered, and armoured with steel tape, and are laid direct in the ground. The distributor cables are four-core, three of the cores being used for the general supply and the fourth core for the street lighting.

The street lighting is controlled from the works by means of remote-control switches, placed at the ends of the feeders and operated by means of pilot wires which run in the same core as the feeder cables. The immediate control of the street lighting from the electricity works effects a great saving in labour, and has been a great convenience in enabling us to switch the street lamps on and off. A special street-lighting wire is advisable, considerably reducing maintenance of the mains, and the labour of lighting and extinguishing. Special all-night lamps or other lamps can efficiently be dealt with by means of time switches.

There are 219 consumers, who at the present time are consuming electricity at the rate of 800,000 units a year. The excessive strain on the plant will be noticed, when a list of 16 comparable undertakings shows an average output of 790 units per kw. of plant as compared with Aylesbury's 2,000 units per kw. of plant.

The capital cost of the undertaking is about £29,000, involving an interest and loan repayment charge of about £3,200 per annum. The financial results of the undertaking for the year ending March 31st last are as follows :—

Units generated, 508,229. Units sold, 415,204. Total cost, 1·43d. per unit sold.

Revenue, £4,293 ; gross profit, £1,837 ; capital charges, £2,559 ; net loss, £722.

☞ Due to the restricted lighting and the Daylight Saving Act, the comparative cost of producing electricity for lighting has been very much increased. A large amount of dead capital is involved, due to the war conditions keeping off the street lighting and private consumers.

* See also Electrical Review, April 19th, 1918.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

13,038, 13,405. "Electrical heating apparatus." J. H. Farthing, M. J. Railing & F. Winstanley. August 12th.

13,049. "Means for controlling alternating currents." British Thomson-Houston Co. (General Electric Co.). August 13th.

13,050. "Electrical signalling apparatus." Sir W. G. Armstrong, Whitworth & Co., C. B. Chicken & J. H. Thain. August 12th.

13,080. "Distribution of electrical energy." C. Grover & W. T. Henley's Telegraph Works Co. August 12th.

13,090. "Electric installations." Soc. Anon. des Etablissements L. Blériot. August 12th. (France, November 23rd, 1917.)

13,104. "Means for making temporary connections with electric supply cables." J. H. Collie. August 13th.

13,105. "Current-collectors for electrically-propelled vehicles." R. H. Wilkinson & A. R. Fearnley. August 13th.

13,125. "Vents for electric accumulators." A. P. Welch & Fuller Accumulator Co. August 13th.

13,151. "Bath for electrolytic tinning." H. Sarrasma. August 13th. (Switzerland, September 27th, 1917.)

13,156. "Electrically operating mechanisms from a distance." A. G. Bloxam (Russische Akt.-Ges. L. M. Ericsson & Co.). August 13th.

13,167. "Variable electric resistances, and apparatus employing same." S. G. Brown. August 13th.

13,187. "Electric batteries." H. F. Joel. August 14th.

13,203. "Apparatus for rectifying alternating current." M. Latour. August 14th. (France, August 14th, 1917.)

13,207/13,208. "Starting devices for alternating current dynamo electric machines." British Thomson-Houston Co., H. C. Hastings & J. Martin. August 14th.

13,231. "Process of electrolytically separating nickel from copper." G. A. Guess. August 14th. (United States, August 14th, 1917.)

13,235. "High frequency alternators." S. Eisenstein. August 14th.

13,282. "Electric controlling-device operable at a distance for laying artillery, projectors, range-finding apparatus, &c." Benard-Barbier et Turenne & E. Granat. August 15th.

13,314. "Apparatus for measuring average maximum demand in kilovolt amperes from an alternating-current supply." A. E. Jepson & A. Howarth. August 16th.

13,321. "High-frequency signalling." Western Electric Co. (Western Electric Co.). August 16th.

13,340. "Electrically-operated fuel valves." British Thomson-Houston Co. (General Electric Co.). August 16th.

13,368/13,369. "Treatment of zinc solutions preparatory to recovery of zinc by electro-deposition." Electrolytic Zinc Co. August 16th. (Australia, August 17th, 1917.)

13,371. "Portable electric batteries." Accumulators, Ltd., & A. Hunter. August 16th.

13,389. "Vents for electric accumulators." Fuller Accumulator Co. & A. P. Welch. August 17th.

13,390. "Electric safety lamps." A. P. Welch & Fuller Accumulator Co. August 17th.

13,411. "Electrically-ignited lighting-device." P. Elphick. August 17th.

13,417. "Telephone apparatus." M. Latour. August 17th. (France, August 18th, 1917.)

PUBLISHED SPECIFICATIONS.

The numbers in parenthesis are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

5,632. Process for the electrolytic deposition of metals. N. H. M. Dekker. April 21st, 1917. (Patent of addition not granted.) (117,638.)

5,663. Dynamo-electric machines. H. Lucas & C. L. Breeden. April 23rd, 1917. (117,639.)

8,713. Locking or securing devices for electric fittings. St. Helens Cable & Rubber Co. & J. C. White. June 18th, 1917. (117,644.)

9,061. Braking systems for electrically driven vehicles. British Thomson-Houston Co. (General Electric Co.). June 23rd, 1917. (117,647.)

10,535. Apparatus for use in electro-plating articles or pieces having holes. Platt Bros. & Co. & G. L. A. R. B. Colin. July 23rd, 1917. (117,658.)

10,739. Devices for securing hawsers, ropes, and the like. W. H. Sandford. July 26th, 1917. (Patent of addition not granted. Cognate application 17,588/17.) (117,677.)

10,785. Methods for forming and treating electrical coils. J. W. Hobley. July 27th, 1917. (117,682.)

10,822. Electrical induction apparatus. British Thomson-Houston Co. (General Electric Co.). July 27th, 1917. (117,685.)

10,830. Utilisation of high frequency oscillations in wireless installations. D. W. Brown. July 27th, 1917. (117,686.)

11,607. Indicating devices for electrical measuring instruments. R. D. Gifford & Nalder Bros. & Thompson. August 13th, 1917. (117,705.)

12,104. Electrical point detectors for railways. A. E. Hudd & G. H. Wion. August 23rd, 1917. (117,712.)

15,741. Electric pocket lamps. E. G. Comp. Phœbus. October 28th, 1916. (110,912.)

16,532. Electric vehicle and other like lamps. H. Lucas & W. H. Eggington. November 10th, 1917. (117,758.)

1918.

2,908. Electric relays, particularly for railway-traffic controlling apparatus. McKenzie, Holland & Westinghouse Power Signal Co. February 20th, 1917. (113,616.)

3,496. Dynamo-electric machines. G. Plaisant. June 22nd, 1917. (Divided application on 18,387/16.) (117,784.)

3,951. Electro-magnetic lockout switches for use in motor control systems. Igranic Electric Co. (Cutler-Hammer Manufacturing Co.) March 6th, 1918. (117,786.)

4,699. Manufacture of commutators. McKenzie, Holland & Westinghouse Power Signal Co. March 16th, 1917. (114,834.)

5,010. Automatic telephone systems. Automatic Telephone Manufacturing Co. July 9th, 1917. (117,411.)